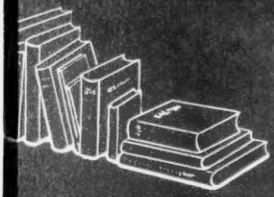
ABSTRACTS OF NORTH AMERICAN GEOLOGY



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ABSTRACTS OF NORTH AMERICAN GEOLOGY

INTRODUCTION

Abstracts of North American Geology contains abstracts of technical papers and books and also citations of maps on the geology of North America including Greenland, the West Indies, as well as the State of Hawaii, Guam, and other island possessions of the United States. Articles of a general nature by North American authors are cited even though published in foreign journals, but those by foreign authors are included only if they appear in North American journals. Abstracts are prepared only of material that is believed to be generally available. Ordinarily abstracts are not published of material with small circulation (such as dissertations, open-file reports or memorandums) or of other papers presented orally at meetings.

The Abstracts is an additional reference tool but does not replace the Bibliography of North American Geology, which has been published by the Geological Survey since 1887. Twelve monthly issues of Abstracts of North American Geology are published each year. The Bibliography includes citations and subject index for a calendar year.

Abstracts of North American Geology and the Bibliography are prepared by use of computer techniques. Each abstract, along with its indexing, is placed on magnetic tape and entered into a permanent data bank. The material prepared each month is published in the form of the present issue. The abstracts are arranged alphabetically according to senior author. A subject index follows the abstracts and is designed for rapid reference to any subject desired. Bibliographies can subsequently be retrieved according to the terms used in the index.

A list of journals commonly cited in Abstracts of North American Geology may be obtained by writing to the U.S. Geological Survey, Washington, D. C. 20242.

The abstracts in this issue were prepared by W. L. Adkison, J. P. Albers, E. E. Angino, R. A. Cadigan, Joan R. Clark, Georgianna D. Conant, Eleanor J. Crosby, W. C. Culbertson, N. M. Denson, K. A. Dickinson, A. A. Drake, W. I. Finch, R. L. Griggs, Andrew Griscom, Bettie S. Hackman, B. C. Hearn, J. J. Hemley, C. W. Hendry, A. V. Heyl, J. W. Hosterman, Virginia M. Jussen, B. H. Kent, R. A. Loney, Elisabeth S. Loud, E. D. McKee, Mildred C. Mead, Virginia S. Neuschel, S. H. Patterson, D. W. Rankin, A. E. Roberts, E. H. Roseboom, G. C. Simmons, Martha S. Toulmin, H. A. Tourtelot, J. G. Vedder, P. K. Venkataraman, Dorothy B. Vitaliano, H. C. Wagner, D. H. Whitebread, R. G. Yates, E-an Zen, and Peter Zubovic.

ABSTRACTS

10068 **Adkison, W. L.** (editor). Stratigraphic cross section of Paleozoic rocks Colorado to New York: Am. Assoc. Petroleum Geologists Cross Sec. Pub. 4, 58 p., illus., 1966.

This cross section interlocks with the Mississippi to Michigan (1954) and Texas to Montana (1960) sections and provides stratigraphic continuity. Seven papers covering different states are cited separately, and cross sections of each accompany the paper.—E.S.L.

10194 **Adler, Lawrence.** Stability evaluation of underground openings based upon a semi-inverse elastic method [with French and German abs.], *in* Internat. Soc. Rock Mechanics Congress, 1st, Lisbon, 1966, Proc., V. 2: Lisbon, Portugal, Laboratório Nacional Engenharia Civil, p. 233–237, illus., 1966.

Semi-inverse methods have been applied with success to problems in soil and structural mechanics, particularly to the stability portion of the total solution. The method has had little success in rock mechanics, but Curved Beam Theory appears to fill this need, first in stress analysis of the solution, and then extended into the stability portion where it calls attention to hitherto neglected tangential shearing stresses. Back-analysis of a variety of field observations indicates the fundamental soundness of the approach: the basic analytical steps blocked-out appear to hold considerable future promise.—*from* Author's conclusions

00161 **Ahnert, Frank.** The role of the equilibrium concept in the interpretation of landforms of fluvial erosion and deposition [abs.]: Assoc. Am. Geographers Annals, v. 57, no. 1, p. 166, 1967.

Alam, A. M. Z. *See* Blench, Thomas. 00305

10335 **Albee, Arden L.; Smith, Jay L.** Earthquake characteristics and fault activity in southern California, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 9–34, illus., tables, 1966.

The elastic rebound theory, magnitude, and intensity of earthquakes and the relation of magnitude to the long axis of the aftershock area and length of surface faulting are discussed. A review of the historic record in southern California shows that the earthquakes are related to the geology, which is dominated by lateral-slip faults and characterized by the juxtaposition of blocks of dissimilar rock types, and structures with different histories. The northwesterly-trending right-lateral fault systems seem most likely to be destructive. An active fault has been defined as a fault which has undergone displacement in Recent time. Dating by overlying deposits is helpful in recognizing fault activity, and regional mechanics can give a broader view. A final section discusses probability estimates of surface faulting and earthquakes.—E.S.L.

00206 **Albers, John P.** Belt of sigmoidal bending and right-lateral faulting in the western Great Basin: Geol. Soc. America Bull., v. 78, no. 2, p. 143–156, illus., 1967.

The southern half of the northwest trending Sierra Nevada is separated from the western Great Basin by a fifty-mile-wide belt of ranges of anomalous and divergent trends that contains in its eastern part a topographically low lineament called the Walker Lane. The arcuate form of several individual ranges, or "oroflexes", defines in the aggregate a regional structure, concave to the northwest, that demonstrably represents a tectonic bending of the crust. In places the tectonic bending is transfrred to strike-slip faults with right lateral strike-slip movement.—R.G.Y.

Aldrich, L. T. *See* Hart, S. R. 00158

Alexander, Shelton S. *See* Phinney, Robert A. 09959

09961 **Alexander, Shelton S.; Phinney, Robert A.** A study of the core-mantle boundary using P waves diffracted by the Earth's core: Jour. Geophys. Research, v. 71, no. 24, p. 5943-5958, illus., tables, 1966.

Ratios of diffracted P spectrums can be used to isolate effects of propagation along the core-mantle boundary, and the rate of attenuation with distance as a function of frequency is a useful quantitative measure of core-mantle properties. Spectrums of the attenuation coefficient for a number of patches on the core-mantle boundary were measured in the 0.01-0.12 cycles per sec frequency range, using data from large earthquakes in different locations. Significant lateral variations in level and shape of the spectrums imply lateral variations in core-mantle properties. Resonance peaks at certain frequencies may be due to layering in the deepest mantle.—D.B.V.

Allen, D. R. *See* Mayuga, M. N. 10235

00124 **Allen, Gary C.** Riebeckite occurrence in southern Virginia: Virginia Minerals, v. 13, no. 1, p. 10, illus., 1967.

Riebeckite, not previously reported in Virginia, was found during an examination of Triassic rocks from southern Pittsylvania County; a relatively common member of the amphibole group, it occurs in sedimentary rocks of undetermined origin which crop out along the Virginia-North Carolina boundary west of Danville. It forms a thin grayish-blue coating along fracture surfaces and is a minor constituent of the host rock; it is usually found in soda-rich syenites, granites, and granite pegmatites. The occurrence of authigenic riebeckite in sedimentary rocks is rare and possibly represents the presence of mineralizing solutions after deposition of the original sediment.—M.C.M.

Allen, L. S. *See* Caldwell, R. L. 10123

10219 **Allen, Ronald V.; Braman, Richard W.; McConnell, Robert K., Jr.; O'Brien, John L.** Transmission electron microscopy of fine-grained rocks: Canadian Mineralogist, v. 8, pt. 4, p. 522-527, illus., 1966.

Rocks too fine grained for mineral identification by the ordinary petrographic microscope can be successfully studied by transmission electron microscopy combined with electron diffraction. Mechanical polishing of the ultra-thin sections is recommended over chemical polishing techniques.—E.Z.

Alto, Bruno R. *See* Stipp, Thomas F. 00184

00152 **Am. Assoc. Petroleum Geologists; U.S. Geological Survey.** Basement map of North America between latitudes 24° and 60° N.: Washington, D. C., U.S. Geol. Survey, scale 1:5,000,000, 1967.

10207 **Ames, L. L., Jr.** Unit cell size and cesium loading on Type A and Type X zeolites: Canadian Mineralogist, v. 8, pt. 4, p. 515-518, illus., 1966.

Curves showing the relationship of mass action quotients, corrected for equilibrium solution activities, and unit-cell dimensions for varying calcium and cesium contents of Type A and Type X zeolites are shown and discussed. It is concluded that the

cation plus water changes of Type A cannot account for the large unit-cell size changes in a sodium-calcium system.—J.R.C.

00231 **Amin, Mohammad.** A nonstationary stochastic model for strong-motion earthquakes [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2341B, 1967.

00123 **Amsbury, David L.** Summary of oil development in the Reno area, Johnson County, Wyoming: Mtn. Geologist, v. 4, no. 1, p. 3–7, illus., 1967.

Reno, East Reno, and Pheasant Fields in Johnson County produce oil from the Permo-Pennsylvanian Minnelusa Formation at a depth 15,000 feet near the axis of the Powder River Basin. Initial completion rates from wells as different as 128 bbls per day on pump from tight sandstone, and 3,420 bbls per day on pump from dolomite have been obtained from wells one-half mile apart at the same structural elevation. The major horizon of dolomite production is about 200 feet below the top of the Minnelusa Formation in Reno and Pheasant Fields. Truncation cut deeply into the Minnelusa prior to deposition of the overlying Goose Egg Formation. The truncation locally removed at least 125 feet of the upper sandstone portion of the Minnelusa but has not yet been found to cut out the underlying dolomite reservoir.—*from* Author's abstract

10144 **Anderson, Alfred T., Jr.** Mineralogy of the Labrieville anorthosite, Quebec: Am. Mineralogist, v. 51, nos. 11–12, p. 1671–1711, illus., tables, 1966.

The Labrieville anorthosite massif is an example of crystallization differentiation in a plutonic environment. The lithologic sequence is: anorthosite (earliest), gabbroic anorthosite, iron-titanium oxide-rich gabbro, and syenite (latest). The earliest liquid consisted of at least 84 percent feldspar constituents and had water fugacity of less than 500 bars. At the oxide-rich gabbro stage, biotite indicates that the lowest crystallization temperature exceeded 880°C and the highest water fugacity was less than 2,000 bars. A massive hemo-ilmenite deposit formed early as a result of immiscibility of silicate and iron-titanium oxide liquids, which separated at about 1100°C or higher, as shown by fractionation of oxygen isotopes. Mineralogic data are given for feldspars, iron-titanium oxides, pyroxenes, apatites and biotites.—B.C.H.

10212 **Anderson, H. Walter; Dodd, Jerry S.** Finite element method applied to rock mechanics [with French and German abs.], *in* Internat. Soc. Rock Mechanics Congress, 1st, Lisbon, 1966, Proc., V. 2: Lisbon, Portugal, Laboratório Nacional Engenharia Civil, p. 317–321, illus., 1966.

An analytical model which simulates the nature of rock is an absolute necessity if any significant progress is to be made in the field of rock mechanics. The finite element method provides such a model and is able to resolve into a unique solution many of the variables encountered in rock mechanics. An example model for determining the stress field acting about an underground opening in a faulted rock mass is shown, and the digital computer program used to obtain the solution is described. Techniques for introducing hydrostatic and tectonic loadings and loads from engineering works and for including creep and anisotropic modulus of elasticity are discussed. The effect of jointing can be incorporated into the finite element method.—*from* Authors' abstract

00304 **Anderson, Henry W.** Abstracted bibliography on erosion of cohesive materials—Discussion [of paper 4746, 1966]: Am. Soc. Civil Engineers Proc., v. 93, Jour. Hydraulics Div., no. HY 1, p. 117–124, 1967.

Abstracts of seven additional articles on soil erosion are given.—J.W.C.

10320 **Anderson, L. A.; Keller, G. V.** Experimental deep resistivity probes in the central and eastern United States: Geophysics, v. 31, no. 6, p. 1105–1122, illus., 1966.

Nine deep resistivity probes were made in southeastern Nebraska, southwestern Iowa, central Pennsylvania, southwestern and northeastern New York, Vermont, New Hampshire, and Maine, in order to determine the requirements for crustal-

scale resistivity surveys in areas where there is no thick overburden of conductive sedimentary rocks. The separations used were adequate for determination of the presence of resistive basement rock but not for penetration of the crust. Methods of achieving larger dipole separations are discussed.—D.B.V.

10186 **Anderson, T. W.; Terasmae, J.** Palynological study of bottom sediments in Georgian Bay, Lake Huron, *in* Great Lakes Research, 9th Conf., Chicago, 1966, Proc.: Michigan Univ. Great Lakes Research Div. Pub. 15, p. 164–168, illus., table, 1966.

A series of surface samples of bottom sediment from precisely located stations has been collected and examined for pollen and spores from central Georgian Bay. The assemblages obtained show a relationship to the surrounding regional vegetation and are different from those obtained from lakes and bogs north and south of Georgian Bay in the boreal and deciduous forest regions, respectively. The dispersal and deposition of pollen in a large body of water requires further study . . . for a reliable interpretation of postglacial pollen diagrams of deep-water sediments in the Great Lakes. A bottom contour map has been prepared from available sounding data. It indictes the presence of a possible submerged valley system in Georgian Bay and shows that infilling by Pleistocene deposits has been insufficient to significantly obscure the preexisting bedrock relief.—Authors' abstract

Anderson, T. W. *See* Lewis, C. F. M. 10188

00211 **Antweiler, J. C.; Love, J. D.** Gold-bearing sedimentary rocks in northwest Wyoming—A preliminary report: U.S. Geol. Survey Circ. 541, 12 p., illus., tables, 1967.

Sequences of gold-bearing quartzite conglomerate occur in Cretaceous and Tertiary formations and Quaternary gravels. Analyses of about 1,200 samples and 750 panned concentrates representing 53 localities show the following averages in parts per billion and cents per cubic yard: Harebell Formation, 65, 11 cents; Pinyon Conglomerate, 86, 14 cents; Fort Union Formation, 35, 6 cents; Eocene conglomerate, 94, 14 cents; Wind River Formation, 222, 35 cents; Pass Peak Formation, 47, 8 cents; Miocene(?) conglomerate, 65, 11 cents; Quaternary deposits, 103, 16 cents. Values are for the bulk rock, although gold is largely confined to sandstone layers and sandy matrix of conglomerates. Conglomerates were derived chiefly from Precambrian and possibly Paleozoic quartzite in a now-buried uplift. Although grade is low, the volume constitutes a resource of enormous proportions.—*from* Authors' abstract

10304 **Arnold, A. B.** The California Aqueduct in southern California, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 57–61, illus., 1966.

In locating the Tehachapi crossing for the California Aqueduct, geologic factors were of paramount significance. A low level tunnel would transect six major faults, as well as meet other adverse factors. The San Andreas fault, with a possible 20 ft offset, would be crossed in sheared sediments 1,000 feet beneath the surface. The higher route chosen could stay in crystalline rocks and avoid crossing faults in four of the tunnels, but requires a high pumping lift. The engineering geology of the tunnels and dams on the East and West Branches of the Aqueduct is described. The West Branch encounters the San Andreas fault at Quail Lake, and will transport the water along the fault for 1.4 mi. A map showing major geologic and engineering features accompanies the paper.—E.S.L.

10318 **Association of Engineering Geologists.** (Los Angeles Sec.) Seminar on "The importance of the earth sciences to the public works and building official"—National meeting, Anaheim, Calif., 1966: Glendale, Calif., Assoc. Eng. Geologists, Los Angeles Sec., 465 p., illus., 1966.

Of the 15 papers presented at this seminar by professional people devoted to solving earth science problems in engineering works of all kinds, 13 are cited individually. The purpose of the seminar is to obtain the most recent data involving topics of most interest to public officials; to outline some of the considerations which should

provide continued improvement of supervision of hillside urban development; and to align the direction in which this improvement should proceed.—G.D.C.

10064 **Atherton, Elwood.** Paleozoic rocks in Illinois, *in* Stratigraphic cross section of Paleozoic rocks—Colorado to New York: Am. Assoc. Petroleum Geologists Cross Sec. Pub. 4, p. 26–31, illus., 1966.

Cross section D–E lies north of the deeper part of the Illinois basin, and is based on 14 well logs. The greatest thickness of Paleozoic rocks is about 7,600 feet, two wells in the west penetrating the Precambrian. All systems are represented except Permian, but the Mississippian and Pennsylvanian are missing over the LaSalle anticline.—E.S.L.

10299 **Babet, Pauline H.** Some characteristics of bentonite in Alberta: Research Council Alberta Prelim. Rept. 66–2, 25 p., illus., tables, 1966.

Bentonites are found throughout southern and central Alberta, mainly in Upper Cretaceous strata. Their wide variations in composition and properties are shown in tables which also include their locations and geologic settings. Some of these bentonites have been or are being mined, primarily for use in drilling mud.—Author's abstract

10052 **Bailey, Robert E.** Postglacial pollen sequence in a bog of the Loesell Field Laboratory of Eastern Michigan University: Michigan Acad. Sci., Arts and Letters Papers 1965, v. 51, p. 167–174, illus., table, 1966.

Peat deposition in the Loesell Bog [Washtenaw County] probably began as the pine maximum was beginning to decrease in this area. Vegetational changes represented in the diagram are the following: from pine to oak and hickory, to beech, elm, ash, and maple, back to an oak–hickory forest, which progressively changed again to a beech–maple forest, and finally to an oak–hickory type which continues to the present. Climatic changes which might be correlated with these vegetational changes are: from cool and somewhat moist to warm and dry, continuing warm but becoming more humid, changing to dry again, and a second change to a more humid condition, and finally to warm and dry. Results from the bog can be correlated with other pollen studies in this area of lower Michigan. Further analysis of pollen from Third Sister Lake (Benninghoff and Southworth, in press) correlates well with Loesell Bog.—Author's summary

00208 **Baird, A. K.; McIntyre, D. B.; Welday, E. E.** Geochemical and structural studies in batholithic rocks of southern California—Pt. 2, Sampling of the Rattlesnake Mountain pluton for chemical composition, variability, and trend analysis: Geol. Soc. America Bull., v. 78, no. 2, p. 191–221, illus., tables, 1967.

The results of 949 new rock analyses from the Rattlesnake Mountain pluton are discussed by means of trend-surface analysis and factor analysis of norms. Hierarchical sampling provided knowledge of the variance within localities in order to conduct chemical mapping. Local rock variability rather than analytical precision is usually the limiting factor.—A.G.

10245 **Baker, Robert F.** Criteria for compacted fills, *in* Seminar on "The importance of the earth sciences to the public works and building official," Anaheim, Calif., 1966: Glendale, Calif., Assoc. Eng. Geologists, Los Angeles Sec., p. 65–99, illus., table, 1966.

In the light of Terzaghi's approach, soils are compacted to improve their shear and settlement characteristics which are related to density and moisture content. Particle size can serve as an empirical guide; surface tension of water in fine-grained soils causes cohesion and plasticity not found in coarser materials. Moisture changes stability of embankments. Weight of overlying soil masses rather than vehicles or buildings causes shear failure in soils. Highways are damaged by both total and differential settlement; compaction reduces both types, the latter serious for all types of structures. Current research, developing new concepts of compaction and criteria for evaluating equipment and methods, suggests that more variability exists in compacted soils than had been supposed.—G.D.C.

00185 **Balsley, J. R.; Smith, C. W.** (compilers). Aeromagnetic map of part of the Winona quadrangle, Ontonagon and Houghton Counties, Michigan: U.S. Geol. Survey Geophys. Inv. Map GP-602, scale 1:62,500, 1967.

00279 **Balsley, J. R.; Petrafeso, F. A.** (compilers). Aeromagnetic map of Iron River and vicinity, Michigan and Wisconsin: U.S. Geol. Survey Geophys. Inv. Map GP-605, scale 1:62,500, 1967.

00156 **Bandy, Orville L.** Cretaceous planktonic foraminiferal zonation: Micropaleontology, v. 13, no. 1, p. 1–31, illus., table, 1967.

Radiometric data and phylogenetic analysis of Cretaceous planktonic foraminifera suggest that the Cretaceous be divided into three epochs rather than two. Primitive globigerines occur in the Lower Cretaceous, single-keeled *Rotalipora* faunas characterize the Middle Cretaceous, and single-keeled and double-keeled *Globotruncana* faunas typify the Upper Cretaceous. Keels arose in three independent generic lines of development in the Upper Cretaceous. Long-ranging tropical species are restricted to very short stratigraphic ranges toward the tropical boundaries defined by *Globotruncana–Rotalipora* lines.—Author's abstract

10163 **Baragar, W. R. A.; Goodwin, A. M.; Souther, J. G.** Volcanism and mineral deposits, *in* Contributions to geological exploration in Canada: Canada Geol. Survey Paper 66-42, p. 8–14, illus., 1966.

The nature of the relationship between volcanism and mineral deposits in Canada varies greatly from place to place; a clearer understanding of volcanism will provide significant insight into ore-forming processes and contribute substantially to long-term mineral exploration in Canada. Three such relationships are described briefly: (1) Stikine area of British Columbia where copper deposits are associated with Triassic volcanic rocks; (2) District of Mackenzie with copper deposits of the Coppermine River basalt flows, copper-nickel deposits of the Muskox Intrusion (crystallized from basaltic magma), and gold deposits of the Yellowknife Group where relations with volcanism are blurred by later events; and (3) Superior Province of the Canadian Shield where volcanic rocks are principal components of the mineralized 'greenstone' belts.—M.C.M.

10131 **Barksdale, Jelks.** Titanium—Its occurrence, chemistry, and technology (2d edition): New York, Ronald Press Co., 691 p., illus., tables, 1966; originally published 1949.

Chapters of the volume pertinent to geology are: discovery, occurrence, geology, and mineralogy of titanium; mineral deposits that yield titanium; chemistry of elemental titanium and titanium salts; and chemical analysis of titanium and its compounds. The remaining chapters are on production, processing, and technology. An extensive reference list for each chapter is appended.—E.S.L.

Barnes, Robert H. *See* Wilson, Charles W., Jr. 10003

Barnes, Robert H. *See* Wilson, Charles W., Jr. 10006

00232 **Baron, William.** The response of cohesive soils to shock loadings [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2342B, 1967.

10132 **Barr, Donald; Geis, Darlene; Keen, Martin L.** The wonders of prehistoric life: New York, Grosset and Dunlap, 160 p., illus., 1966.

The record of the past as seen in rocks and fossils is reviewed as an introduction to this elementary account. The succession of living things is divided into the age of hidden life, invertebrates and fish, sharks and amphibians, reptiles, and mammals. The last 55 pages are devoted to primitive man.—E.S.L.

10056 **Barton, Robert H.** Photogeology, *in* Commonwealth Mining and Metall. Cong., 8th, Australia and New Zealand, 1965, Proc.—Petroleum, Pubs., V. 5: Melbourne, Australia, Australasian Inst. Mining and Metallurgy, p. 21–29, illus., 1966.

Photogeologic mapping was initially confined to preparation of surface geologic maps. Other useful applications are regional studies, in connection with geophysical exploration, mineral investigation, and geomorphic interpretation. Photogrammetric plotters produce data that can be used for structure contouring, stratigraphic section measurement, low-dip determination, and access route location. Illustrated examples are an interpretation of a photomosaic of Isachsen dome, Northwest Territories, and making of a structure contour map on a coal horizon and estimating overburden.—E.S.L.

00193 **Baxter, Robert W.** A revision of the sphenopsid organ genus, *Litostrobus*: Kansas Univ. Sci. Bull., v. 47, no. 1, p. 1–23, illus., 1967.

Fragments of *Litostrobus* cones from coal balls of the Desmoinesian Stage, Middle Pennsylvanian of Iowa are described. A wide variation in number and arrangement of sporangia and bracts occurs in different whorls of individual cones with an apparent decrease in number towards the cone apex. Heteromorphism of 14 to 6 sporangia per whorl is accompanied by changes in the number and arrangement of the subtending bracts so that apical whorls of 6 sporangia may have double the number of alternate and opposite bracts while basal whorls of 14 sporangia may have only an equal number of alternate bracts. The cone of *Mesidiophyton* Leisman is shown to be cogeneric with *Litostrobus* but to constitute a distinct species, *L. paulus*. New diagnoses are given for *L. iowensis and L. paulus*. Possible relationships of *Sphenostrobus to Litostrobus* are discussed.—*from* Author's abstract

10259 **Bayly, M. B.** Flow sheets for mineral identification: Jour. Geol. Education, v. 14, no. 5, p. 195–196, illus., 1966.

An introductory course in mineralogy should teach mineral recognition with the accent on the recognition process; the flow-sheet format is suggested as an aid. The development of such a sheet by the student has the advantages of being individual, no two alike, and open-ended so it can grow. Every wrong identification calls for a change. A flow sheet can be multi-channeled to fit different forms of the same mineral, and it can show levels of confidence. The student learns to distinguish diagnostic from non-diagnostic properties.—E.S.L.

00175 **Beheiry, Salah A.** Sand forms in the Coachella Valley, southern California: Assoc. Am. Geographers Annals, v. 57, no. 1, p. 25–48, illus., tables, 1967.

Coachella Valley in southern California is in places mantled by sand deposits. From the source of the sand, alluvial deposits in the north end of the valley, prevailing winds sift out finer materials and move them southward, creating several kinds of sand forms during transport. Knob dunes, which may occur in large dune fields, wave dunes, which are barchan-like in form, mesquite-hill dunes, which collect around patches of mesquite, and other sand forms such as sand drifts, sand undulations, and sand veneers are present. Although present conditions of sand transport are affected by cultural interference, there is a sequential aspect to the development of sand forms, in which the sand veneer thickens into a field of knob dunes, may become a moving field of undulating form, ending in the barchan-like form in terminal downwind locations.—*from* Author's abstract

10017 **Bell, Richard Thomas.** Precambrian rocks of the Tuchodi Lakes map area, northeastern British Columbia, Canada [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1978B, 1966.

10018 **Berry, Michael John.** Some interpretation techniques in crustal seismology with application to the Lake Superior Experiment [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1978B–1979B, 1966.

Berti, A. A. *See* Lewis, C. F. M. 10188

Bhappu, Roshan B. *See* Deju, Raul A. 09955

10165 **Bhattacharyya, B. L.** Quantitative interpretation of aeromagnetic information, *in* Contributions to geological exploration in Canada: Canada Geol. Survey Paper 66-42, p. 22–23, 1966.

Quantitative interpretation of aeromagnetic information by digital computers in the Geological Survey of Canada involves digitizing magnetic field values from an aeromagnetic map, removing from the data the 'regional' or latitude variation, and expressing the 'residual' by a two-dimensional Fourier series to give the analytical expression for the data. For an areal study the second vertical derivative of the total field, and the total field reduced-to-the-pole and its second derivative are determined; from these it is possible to calculate from a magnetic anomaly the horizontal dimensions, depths to top and bottom of the body, and intensity and direction of magnetization. Studies are being conducted also to delineate deep crustal magnetic sources from the total field data and an extensive aeromagnetic interpretation map program has been undertaken for direct use in mineral exploration.—M.C.M.

00174 **Bishop, Bobby Arnold.** Stratigraphy and carbonate petrography of the Sierra de Piachos and vicinity, Nuevo León, Mexico [abs.]: Houston Geol. Soc. Bull., v. 9, no. 6, p. 18–19, 1967.

00166 **Bishop, William F.** Age of pre-Smackover formations, north Louisiana and south Arkansas: Am. Assoc. Petroleum Geologists Bull., v. 51, no. 2, p. 244–250, illus., 1967.

Pre-Smackover formations in southern Arkansas and northern Louisiana are assigned to the following ages: Norphlet Formation to Upper Jurassic; Louann Salt and Werner Formation to Middle or Lower Jurassic; Eagle Mills Formation to Upper Triassic; and Morehouse Formation to Middle or Upper Pennsylvanian.—A.E.R.

09975 **Black, Craig C.; Dawson, Mary R.** Paleontology and geology of the Badwater Creek area, central Wyoming—Pt. 1, History of field work and geological setting: Carnegie Mus. Annals, v. 38, art. 13, p. 297–307, illus., table, 1966.

Since 1962 the Section of Vertebrate Fossils of Carnegie Museum have explored Tertiary deposits and collected fossils between Badwater Creek and Cedar Ridge fault, northeastern Wind River basin, Natrona and Fremont Counties, Wyo. Tourtelot (1946–57) and others worked in the area previously. Fifteen collecting localities reveal four faunal horizons: Shotgun Butte Member of Fort Union Formation, late Paleocene; lower green and brown member of Tepee Trail Formation, late early Eocene; Hendry Ranch Member of Tepee Trail, late Eocene; tan silts above Tepee Trail, late Oligocene. The mammals of the Hendry Ranch fauna were recovered by a washing technique mostly as isolated teeth; 28 to 30 species added (P. Robinson et al., 1964) to the 28 recognized by Gazin (1956) include 18 genera new to the late Eocene of North America.—V.M.J.

10187 **Black, Robert F.** Valders glaciation in Wisconsin and upper Michigan—A progress report, *in* Great Lakes Research, 9th Conf., Chicago, 1966, Proc.: Michigan Univ. Great Lakes Research Div. Pub. 15, p. 169–175, illus., 1966.

Reconnaissance in northern Wisconsin and contiguous upper Michigan suggests 1) the Valders ice did not reach northcentral Wisconsin, apparently being confined to the eastern half of Lake Superior and to the northern part of Lake Michigan; 2) the Valders ice did appreciable work between those lakes, striating bedrock and building drumlins, end moraines, outwash plains, and stagnant ice features; 3) the ice during at least one pulse deployed radially outward from a center between those lakes; and 4) there the Valders drift is characteristically not red clayey till as it is to the south, but it is sandy and stony.—Author's abstract

10312 **Blake, W., Jr.** End moraines and deglaciation chronology in northern Canada, with special reference to southern Baffin Island: Canada Geol. Survey Paper 66–26, 31 p., illus.; tables, 1966.

A major end moraine system, 325 mi long, crossing Frobisher Bay, Northwest Territories, has been mapped accurately for the first time. High-level strandlines reported earlier are part of this system; a second end moraine crossing Foxe Peninsula is thought to correlate with it. Carbon-14 dates indicate that some segments of the Frobisher Bay system were forming about 8,200 B.P., and continued

to form for several hundred years. Dates on marine shells south of James Bay suggest that Hudson Strait was open slightly before 8,000 yr ago, and that the ice sheet was disintegrating into separate masses. Ice remained longer in Foxe Basin; dates on shells are close to 6,900 and 6,700 B.P. It is concluded that the Cockburn Glacial Phase needs critical evaluation after more C-14 dates become available. A map shows glacial features and C-14 dates.—E.S.L.

00305 **Blench, Thomas; Kennedy, John F.; Alam, A. M. Z.** Hydraulic resistance of alluvial streams—Discussions [of paper 4738 by Frank Engelund, 1966]: Am. Soc. Civil Engineers Proc., v. 93, Jour. Hydraulics Div., no. HY 1, p. 108–117, illus., tables, 1967.

Formulas for predicting friction factors of alluvial-channel flow presented by Engelund are analyzed. Data from the Engelund article are plotted on a graph to determine whether or not the streams were the "average" type. The introduction of R′, which is the hydraulic radius of a given river, is contested. Stage-discharge relationships were prepared for several natural streams to evaluate Engelund's approach. The results are in general satisfactory.—J.W.C.

10019 **Block, Douglas A.** Glacial geology of the north half of Barnes County, North Dakota [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1979B–1980B, 1966.

10092 **Blumenstock, David I.** (editor). Pleistocene and post-Pleistocene climatic variations in the Pacific area, a symposium—Pacific Sci. Cong., 10th, Honolulu, 1961: Honolulu, Hawaii, Bishop Mus. Press, 182 p., illus., tables, 1966.

This volume includes nine papers by individuals who have done work in Alaska, western United States, Patagonia, Antarctica, New Zealand, Hawaii, and Japan; four papers are cited separately. The volume is in part a memorial to the editor, who died in 1963.—E.S.L.

00157 **Bold, W. A. van den.** Miocene Ostracoda from Costa Rica: Micropaleontology, v. 13, no. 1, p. 75–86, illus., table, 1967.

Forty-four species of ostracodes are listed from the Miocene of eastern Costa Rica in the region of Río Reventazón. Similarity to faunas from the Panamá Miocene is discussed, and correlations with the Gatún and Caimito Formations and the La Boca Member of the Panamá Formation are suggested. Three new species—*Costa stokesae, Costa barrocoloradensis and Ambocythere? costaricana*—are described, and six other species are discussed in some detail.—Author's abstract

Bollinger, G. A. *See* Stauder, William. 10096

Bowles, C. Gilbert. *See* Finnell, Tommy L. 00219

00173 **Boyd, James.** The influence of the minerals industry on general economics: Mining Eng., v. 19, no. 3, p. 54–59, table, 1967.

Raw materials are the basis for the entire economic process but society has often hampered the growth in raw material supply. Three basic problem areas which modify the economics of mining are: (1) failure to recognize and provide incentive to overcome the long-range and inherent risks of investment, (2) the increasing amounts of research required to find and extract minerals from lower grade ore bodies, and (3) governmental action detrimental to the expansion of the mineral supply. (This is the 1967 Jackling lecture.)—F.C.C.

00239 **Bradshaw, Lael Marguerite Ely.** Conodonts from the Fort Peña Formation, Marathon Basin, Brewster County, Texas [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2406B, 1967.

10192 **Bradshaw, R. L.; Lomenick, T. F.; McClain, W. C.; Empson, F. M.** Model and underground studies of the influence of stress, temperature, and radiation on flow and stability in rock salt mines [with French and German abs.], *in* Internat. Soc.

Rock Mechanics Cong., 1st, Lisbon, 1966, Proc., V. 2: Lisbon, Portugal, Laboratório Nacional Engenharia Civil, p. 429–433, illus., 1966.

For purposes of studying the effects of disposal of radioactive waste in salt mines, laboratory and salt mine tests have been carried out. Several different types of gages were used to measure convergence, strain, strain rate, and stress change due to high temperature and radiation effects. Model test results correlated well with underground measurements. Immediately after insertion of radioactive heat sources into the mine floor thermal stresses were transmitted to the roof and resulted in a fivefold increase in rate of sag of the 2-ft salt layer. Radiation produced minor changes in salt properties but thermal effects are much more important under mine conditions.—V.S.N.

Braman, Richard W. *See* Allen, Ronald V. 10219

09953 **Brandon, L. V.** Groundwater probability, Truro (west half), Nova Scotia: Canada Geol. Survey Map 1160A, scale 1:253,440, sections, text, 1966.

On the basis of present information, water-yielding properties are given for: estuarine deposits, which do not readily yield potable water; glaciofluvial deposits, from which quality should be excellent, however, variable thickness and variety of grain size make it impractical to predict yield; basalt, probably small yield but good quality; Annapolis Formation, highest reported yield of 400 gpm, quality excellent but varies with depth; Pictou and Cumberland Groups, yield range from 5–75 gpm and excellent quality; Riversdale and Canso Groups, variable quality, and 5–25 gpm range of yield, some being highly mineralized; Windsor Group, variable in both yield and quality; Horton and River John Groups, expectant yield 5–25 gpm and variable chemical quality; Cobequid complex and dike rocks, excellent quality but low yield (1 gpm); and Meguma Group, small supplies and probable high iron content.—M.C.M.

00200 **Branson, Carl C.** Memorial to Frank Buttram (1886–1966): Oklahoma Geology Notes, v. 27, no. 2, p. 23, 1967

00240 **Bridge, Thomas E.** Contact metamorphism in siliceous limestone and dolomite in Marble Canyon and geology of belated intrusion, Culberson County, Trans-pecos Texas [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2407B, 1967.

00117 **Briggs, L. I.; Pollack, H. N.**—Digital model of evaporite sedimentation: Science, v. 155, no. 3761, p. 453–456, illus., 1967.

A deterministic digital model to simulate evaporite sedimentation permits experimentation with depth of water, shape of salt basin, number, position and strength of inlets, and rate of evaporation. It provides a reasonable fit to salt thickness and distribution in the Upper Silurian Salina Formation of Michigan.—Authors' abstract

10200 **British Columbia Dept. Mines.** (and Petroleum Resources). Geological mapping in British Columbia to March 1966: Victoria, B. C., British Columbia Dept. Mines and Petroleum Resources, 21 p., illus., 1966.

The map accompanying the key is an index to published geological mapping in British Columbia, revised as of May 1966. The key indicates name of publication, whether a report is available with map, if a separate map is available, or if the publication is out of print.—M.C.M.

Bromery, R. W. *See* Kane, M. F. 10108

Brooker, E. J. *See* Harris, D. C. 10152

09997 **Brooner, Frank I.** The North LaWard shale diapir: South Texas Geol. Soc. Bull., v. 6, no. 19, p. 6–19, illus., 1966.

This structure, located on the west edge of the North LaWard Field, Jackson County, Tex., is studied as a typical pure shale diapir in the Frio-Oligocene trend

of the Gulf Coast. As shown on a series of structure contour and isopach maps, the stock of underlying Jackson or Vicksburg marine shale has intruded the Lower Frio Formation to about 1100 feet above the base of the Frio (depth of base about 7800 feet, thickness of total Frio about 2700 feet). Most Lower Frio reservoirs have been truncated and displaced by the shale, probably in Upper Frio time; relatively small amounts of oil and gas are found. The shale diapirs appear to be a less attractive exploration target than the associated deep-seated structures, suspected of being nonpiercement shale domes, which underlie profitable Lower Frio oil and gas fields such as Una West, Portilla, and Copano.—V.M.J.

10297 **Brown, C. Ervin; Thayer, T. P.** Geologic map of the Mount Vernon quadrangle, Grant County, Oregon: U.S. Geol. Survey Geol. Quad. Map GQ-548, scale 1:62,500, sections, separate text, 1966.

The geologic history of the Mount Vernon quadrangle can be divided into: pre-Late Triassic sedimentation, volcanism, and orogeny; Late Triassic(?) and Early Jurassic volcanism, sedimentation, and tectonism; Late Jurassic(?) and Early Cretaceous dioritic intrusions; and Tertiary and Quaternary volcanism, sedimentation, and tectonism. These main episodes are described and illustrated on a chart. Deformation of the Picture Gorge Basalt has produced important structural traps for ground water. The John Day fault and southward-dipping rocks in the down-thrown block to the north together form a major structural reservoir. Because of the importance of the John Day fault to production of ground water, it is emphasized that its trace is concealed by alluvium at most places.—M.C.M.

00297 **Brown, Robert D., Jr.; Rich, Ernest I.** Implications of two Cretaceous mass transport deposits, Sacramento Valley, California—Comment on a paper by Gary L. Peterson [1965]: Jour. Sed. Petrology, v. 37, no. 1, p. 240-248, illus., 1967.

Peterson's [ibid., v. 35, p. 401-407, 1965] hypothesis of a disconformity between the Cretaceous Antelope Shale and overlying Venado Formation is rejected on the basis of: (1) observed contact relations; (2) mapped intertonguing of the units; (3) parallelism of the units; and (4) autochthonous fossils. A structural movement involving faulting, uplift of the shoreline, and slumping and erosion of the uplifted block contemporaneous with deposition of the Antelope Shale is a more plausible explanation for slump material along the Antelope-Venado contact.—R.A.C.

10279 **Brucker, Roger W.** Truncated cave passages and terminal breakdown in the central Kentucky karst: Natl. Speleol. Soc. Bull., v. 28, no. 4, p. 171-178, illus., 1966.

In the Flint Ridge and Mammoth Cave systems in Mammoth Cave National Park, Ky., truncated cave passages are segments of formerly continuous passages that have been terminated at one or both ends by collapse. Valley erosion truncates an impermeable caprock, concentrating vertically seeping water along specific areas of descent. Solution weakens the rock which collapses into cave passages. Terminal breakdowns are piles of rock debris which terminate passages as a result of truncation. Segments of formerly continuous passages have similar size, shape, elevation, alignment, and cross-section. Understanding of the process and its results leads to reconstruction of past cave patterns essential to studies of cave genesis.—*from* Author's abstract

Brydon, J. E. *See* Turner, R. C. 00122

10253 **Buchanan, Spencer J.** Engineering control of expansive soils, *in* Seminar on "The importance of the earth sciences to the public works and building official," Anaheim, Calif., 1966: Glendale, Calif., Assoc. Eng. Geologists, Los Angeles Sec., p. 449-465, illus., 1966.

Accumulated knowledge of the mechanism of expansive clays is reviewed. Much has been learned in 30 odd years about the adsorbed water complex, exchangeable bases, lattice structure, and related matters associated with swelling and shrinkage of clay. With remarkable agreement in many of the research findings over the world, the most fundamental is that volumetric changes are a direct but nonlinear function of moisture changes. To date ready means have not been available for realistic

and economic delineation of the depth of the zone of moisture variation, although several methods in use are described briefly. Stabilization of in-situ moisture content for the life of the supported structure is one means of control; another is by introducing calcium to the clay, done in Oklahoma by filling small drilled holes with a CaOH slurry.—G.D.C.

10020 **Buchwald, Caryl Edward.** Types and distribution of sandstones in the Belly River and Edmonton Formations (uppermost Cretaceous) of the North Saskatchewan River area, west-central Alberta [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1980B, 1966.

00299 **Burford, Arthur E.** Normal faulting in parts of Browns Mountain anticline, West Virginia [abs.]: West Virginia Acad. Sci. Proc. 1966, v. 38, p. 168, 1967.

00302 **Burford, Arthur E.** Deep structure near Harpers Ferry, West Virginia [abs.]: West Virginia Acad. Sci. Proc. 1966, v. 38, p. 185, 1967.

Busek, Peter R. *See* Huss, Glenn I. 09989

09993 **Butler, Clay P.** Temperatures of meteoroids in space: Meteoritics, v. 3, no. 2, p. 59–70, illus., table, 1966.

On the basis of reported optical measurements of iron and stony meteorites, upper and lower limits for solar absorptance and hemispherical emittance of the surfaces of meteoroids have been established. Temperatures of three classes of meteoroids, none larger than approximately 10 m in radius, have been calculated for various orbits and a/e ratios. These classes are light chondrites, dark chondrites, and the irons. Temperatures for a meteoroid in a Mercury orbit range from 100°C for a light chondrite to 400°C for an iron.—Author's abstract

10009 **Byrne, John V.; Fowler, Gerald A.; Maloney, Neil J.** Uplift of the continental margin and possible continental accretion off Oregon: Science, v. 154, no. 3757, p. 1654–1656, illus., tables, 1966.

Sedimentary rocks collected from the continental shelf and slope off the central coast of Oregon contain fossil benthic foraminifers of Pliocene and Miocene age. These fossils indicate water depths much greater than those from which the rocks were collected, implying that the rocks have been uplifted as much as 1,000 m since their deposition. Uplift of this magnitude near the edge of the continent is interpreted as representing an early stage of continental accretion, possibly as a result of compression normal to the continental margin. The average maximum horizontal component of this accretion would be about 16 km.—Authors' abstract

Cabrera, A. *See* Caillère, S. 09951

09951 **Caillère, S.; Cabrera, A.** Étude minéralogique de quelques argiles provenant du Mexique: [France] Centre Natl. Recherche Sci. Groupe Français Argiles Bull., new ser., v. 18, no. 14, p. 75–84, illus., tables, 1966.

[Five] samples of clays from Villa Juarez, Puebla, and [two] from Tula, Hidalgo, were studied by various methods. The results show that all these clays are kaolinitic. Those from Puebla have the characteristics of a surface deposit resulting from lateritic alteration. Those from Hidalgo contain alunite, the origin of which may perhaps be attributed to the final phases of volcanic activity.—*from* Authors' abstract

Caldwell, A. C. *See* Li, Paulina. 10169

10123 **Caldwell, R. L.; Allen, L. S.; Mills, W. R.** Theoretical and experimental model results in neutron lifetime logging [with French, Russian, Spanish abs.], *in* Radioisotope instruments in industry and geophysics—A symposium, Warsaw, 1965, Proc., V. 2: Vienna, Austria, Internat. Atomic Energy Agency, p. 69–83, illus., tables, 1966.

Investigation of borehole and formation parameters in neutron lifetime logging requires controlled experiments in a realistic physical model or a satisfactory theoretical model. The authors have developed a numerical computer code to solve the time-dependent, three-group diffusion equations which apply to borehole geometry, and have built silicate and calcium carbonate models in which formation and borehole parameters are easily changed. Test calculations verifying the computer program are presented for salt water and fresh water (or oil) saturation of a porous sand. Effects of fluid invasion were calculated to estimate depth of investigation of pulsed neutron logging. Merits of heterogeneous versus homogeneous simulation of rock formations in a physical model are discussed.—*from* Authors' abstract

Calvin, Melvin. *See* Eglinton, Geoffrey. 00223

10314 **Carrigy, M. A.** Lithology of the Athabasca Oil Sands: Research Council Alberta Bull. 18, 48 p., illus., tables, 1966.

The Athabasca oil sands sequence includes a basal coarse-grained quartzose sand and the overlying McMurray and lower Clearwater Formations. The series is a deltaic-transgressive marine facies of which the lower part consists of fluviatile deposits, the middle and upper parts of forset and topset delta beds overlain by nearshore continental shelf sediments of the lower Clearwater Formation. The heavy minerals, derived from metamorphic and igneous provenances, are distributed according to grain size and shape at the source. Sorted by traction currents and winnowed by oscillatory currents, the porosity of the oil sands is intergranular. Most of the oil is in fluviatile sands and fine-grained micaceous foreset beds. G.D.C.

10021 **Carter, John Lyman.** Mississippian brachiopods from the Chappel limestone of central Texas [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1980B, 1966.

Case, J. E. *See* Joesting, H. R. 10002

00132 **Catanzaro, E. J.** Correlation of some Precambrian rocks and metamorphic events in parts of Wyoming and Montana: Mtn. Geologist, v. 4, no. 1, p. 9–21, illus., tables, 1967.

A survey of the geology and geochronology of six areas in Wyoming and Montana, including the Beartooth, Bighorn, Wind River, Little Belt and Medicine Bow Mountains, and southwestern Montana, suggests the presence of only three dateable pre-Belt Precambrian events: (1) >3100 m.y.—the formation of the detrital zircon material now found in the Beartooth Mountains rocks; (2) 2700 m.y.—a metamorphic event in all six areas; (3) 1900 m.y.—a metamorphic event in the Little Belt and Medicine Bow Mountains and southwestern Montana. The age results suggest the possibility of stratigraphic correlation of metasedimentary rock formations in all six areas.—Author's abstract

10218 **Chamberlain, J. A.** Heazlewoodite and awaruite in serpentinites of the eastern townships, Quebec: Canadian Mineralogist, v. 8, pt. 4, p. 519–522, illus., tables, 1966.

Heazlewoodite plus magnetite and awaruite plus magnetite apparently form in different zones within ultramafic bodies as by-products of serpentinization. There is apparently an antipathy between heazlewoodite and awaruite.—E.H.R.

00138 **Chancellor, Robert E.** Economic analysis of Cretaceous oil exploration, Denver basin, Colorado and Nebraska: Mtn. Geologist, v. 4, no. 1, p. 23–34, illus., tables, 1967.

Data resulting from an investor-oriented study of the Denver basin show that moderate, predictable profits of 180 percent per year *after taxes* have resulted from well planned, sustained exploration programs. Results of similar studies in other basins, when shared by the profession, will help speed restoration of the geologist

to his former position of decisive advisor to the exploration investor.—*from* Author's abstract

Chapman, Keith P. *See* McConnell, Harold, 00140

00289 **Chappell, John.** Recognizing fossil strand lines from grain-size analysis: Jour. Sed. Petrology, v. 37, no. 1, p. 157–165, illus., 1967.

Modern beach and dune sands may be differentiated through use of the grain-size distribution moment measure of skewness. Discrimination between beach and dune sands is poor for skewness measures obtained by graphic methods for samples which contain mixtures of two or more particle-size distributions and for lithified sands. Results depend more on the method of obtaining the skewness values than on the method of grain-size analysis.—R.A.C.

10016 **Cheng, Mary Mei-Ling Huang.** Isotopic thorium and isotopic uranium compositions of modern and fossil marine molluscan shells [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1756B, 1966.

00303 **Chitale, Shrikrishna V.; Galay, Victor J.; Neill, Charles R.** Nomenclature for bed forms in alluvial channels—Discussion [of paper 4823, 1966]: Am. Soc. Civil Engineers Proc., v. 93, Jour. Hydraulics Div., no. HY 1, p. 127–133, illus., tables, 1967.

The report of the Task Force on Bed Forms in Alluvial Channels of the Committee on Sedimentation is reviewed critically. Addition of some new bed forms and amplification of distinguishing characteristics of various bed forms are suggested. Bed configuration, flat beds, ripples, dunes and crescent-shaped bars are discussed specifically.—J.W.C.

00233 **Chopra, Anil Kumar.** Earthquake effects on dams [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2344B, 1967.

10277 **Chute, Newton E.** Geology of the Norwood quadrangle, Norfolk and Suffolk Counties, Massachusetts: U.S. Geol. Survey Bull. 1163-B, p. B1–B78, illus., table, geol. maps, 1966.

Bedrock of the Norwood quadrangle, southwest of Boston, is igneous and sedimentary. Intrusive rocks are divided into four groups: (1) Salem Gabbro Diorite, Newburyport Quartz Diorite, Dedham Granodiorite, Westwood Granite—all Precambrian or early to middle Paleozoic; (2) diorite, Sharon Syenite, fine grained granite, and aplite—age intermediate between group 1 and 3; (3) Blue Hill Granite Porphyry—Devonian or Carboniferous; (4) diabase dikes—mostly Carboniferous. Sedimentary formations are Roxbury Conglomerate—Devonian or Carboniferous, and Pondville Conglomerate and Wamsutta Formation—Carboniferous. Metamorphic rocks present are of small extent. Two orogenies are recognized. Extensive glacial deposits are described. Deposits of economic value are sand and gravel; bedrock formations are a potential source of building stone and crushed rock.—V.S.N.

09970 **Clarke, O. M., Jr.; Smith, W. Everett; Szabo, Michael W.** Mineral resources map of Covington County, Alabama: Alabama Geol. Survey Map 51, scale about 1 in. to 2 mi., text, 1966.

Tertiary and Quaternary rocks consisting chiefly of sand, clay, claystone, marl, and limestone underlie Covington County; their general description is given in a table. Clay of potential economic significance occurs in units of the Eocene Claiborne Group and in Miocene rocks. Brown iron ore deposits of unproven grade and extent occur in the northern section; records of prospecting are not available. Limestone of Eocene and Oligocene age occurs in the southern and southwestern areas; in outcrop the strata are mostly deeply and irregularly weathered with few exposures of unweathered limestone. Sand of potential economic significance occurs at the base of the Lisbon Formation and in alluvium along the Conecuh River.—M.C.M.

09971 **Clarke, O. M., Jr.; Smith, W. Everett; Szabo, Michael W.** Mineral resources map of Conecuh County, Alabama: Alabama Geol. Survey Map 52, scale about 1 in. to 2 mi., text, 1966.

A generalized description of the Eocene to Recent rocks cropping out in Conecuh County is presented in a table. Clay is abundant but most outcrops are limited to eroded hillsides. The thickness of the clay bed in the Eocene Tallahatta Formation exceeds 20 feet; more than 10 million tons are estimated as available for development. Lenticular clay beds occur in the lower Citronelle Formation but areal extent and thickness are not known. Four limestone formations underlie much of the southern and southwestern parts of the county, best exposures occurring north of Castleberry. Sand of potential economic significance occurs at the base of the Eocene Lisbon Formation and as a matrix in gravel deposits of the Citronelle Formation, Catahoula Sandstone, and Paynes Hammock Sand.—M.C.M.

09972 **Clarke, O. M., Jr.; Szabo, Michael W.** Mineral resources map of Bullock County, Alabama: Alabama Geol. Survey Map 53, scale about 1 in. to 2 mi., text, 1966.

Late Cretaceous to Recent sedimentary rocks crop out in Bullock County and consist chiefly of clay, sand, and chalk. A generalized description of the rock units is given in a table; the areal distribution and detailed description is found in Alabama Geol. Survey Inf. Ser. 29 (Scott, 1962). Extensive deposits of clay occur in areas underlain by Mooreville Chalk, predominantly an argillaceous chalk or soft limestone grading from the north eastward into a calcareous clay; more than 40 million tons are available for commercial development. Sand has not been produced commercially but alluvial deposits in the central part have potential economic significance.—M.C.M.

09973 **Clarke, O. M., Jr.; Smith, W. Everett; Szabo, Michael W.** Mineral resources map of Escambia County, Alabama: Alabama Geol. Survey Map 50, scale about 1 in. to 2 mi., text, 1966.

Eocene to Recent rock units in Escambia County (sand, clay, silt, gravel, marl, and limestone) are listed in a table; areal distribution and detailed description are shown on Alabama Geol. Survey Map 26 (Cagle, 1963). Northwest of Pollard, oil has accumulated along fault zones where permeable sands are in contact with impermeable beds. Sand and gravelly sand of the Citronelle Formation (Pliocene) are used mainly for brick and tile. The Ocala and Marianna Limestones and the Glendon Limestone Member of the Byram Formation form an almost continuous sequence of calcareous sediments ranging in thickness from 70–120 feet, and it is estimated that about 19 million tons are available from the upper 20 feet of limestone. The Citronelle Formation, Miocene Catahoula Sandstone and Paynes Hammock Sand contain sand and gravel of economic significance.—M.C.M.

Clay, C. S. *See* Nawar, F. G. 10135

09980 **Clayton, K. M.** Reply to Professor Coates [Discussion of "Glacial erosion in the Finger Lakes Region (New York, U.S.A.)", 1965]: Zeitschr. Geomorphologie, new ser., v. 10, no. 4, p. 475–477, 1966.

Comments by Coates (ibid., p. 469–474), are dealt with in turn, following an outline of the fundamental difference in both authors' views on the role of ice in this area. Many of the larger features, ascribed by Coates to the action of glacial meltwater, were merely touched up by it after glacial erosion; earlier glacial phases are extinguished by till and later revealed by new channel cuts; his assigning of particular features to fluvial activity fails to consider the convergent evidence for intense glacial erosion, one feature of which is its great spatial variation. Ambiguities about the plateau surface are resolved in the varying scale of evidence. Much of Coates' argument is concerned with the Binghamton area where extent of glacial erosion is much less than to the north. Discordant junctions are typical of the trough valley zone. Inferred southwesternly drainage was probably tributary to the Chemung River.—G.D.C.

09948 **Clayton, Lee.** Notes on Pleistocene stratigraphy of North Dakota: North Dakota Geol. Survey Rept. Inv. 44, 25 p., illus., tables, 1966.

An attempt is made to correlate most of the radiocarbon dates of North Dakota with named phases of glaciation or phases of Lake Agassiz and to correlate these with dated events in surrounding areas.—M.S.T.

Clemency, Charles V. *See* Izard, John E. 00294

10305 **Clements, Thomas.** St. Francis Dam failure of 1928, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 88–91, illus., 1966.

The failure of the St. Francis Dam, near Saugus, Calif., did more to focus attention on the need for geologic advice in locating dam sites than any other event. The east end of the dam was notched into the Precambrian Pelona Schist whose planes of schistosity were parallel to the wall. Landslide scars showed that the schist was unstable. The westerly abutment was formed of red continental Tertiary rocks which disintegrated in water. The contact between these two types of rock was a fault zone about one-third of the way up the west wall. When the dam went out, chunks of the west end were carried down stream, the east end collapsed in place, and the center section stood.—E.S.L.

00241 **Clemons, Russell Edward.** Geology of the Chiquimula quadrangle, Guatemala, Central America [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2407B–2408B, 1967.

Clendening, John A. *See* Gillespie, William H. 00180

00300 **Clendening, John A.** *Schopfipollenites* in the Washington Formation, Dunkard Group, Upper Pennsylvanian of West Virginia and Pennsylvania: West Virginia Acad. Sci. Proc. 1966, v. 38, p. 169–176, illus., 1967.

The occurrence of four species of *Schopfipollenites* in the Jollytown coal is reported. *Schopfipollenites varius* sp. nov. is proposed. Associated spores indicate a Stephanian age for the Jollytown coal and associated strata.—Author's abstract

10232 **Cleveland, George B.** (compiler). Current regional geologic studies in southern California, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 214–215, 1966.

Fourteen mapping programs, the results of which will be published, are tabulated, including the name of the organization and the map scale.—E.S.L.

10210 **Coates, D. F.** The effect of stress concentrations on the stability of tunnels [with French and German abs.], *in* Internat. Soc. Rock Mechanics Congress, 1st, Lisbon, 1966, Proc., V. 2: Lisbon, Portugal, Laboratório Nacional Engenharia Civil, p. 299–305, illus., tables, 1966.

Stress concentrations around an underground opening may theoretically exceed the strength of the rock mass. Deviations of actual rock properties from those of homogeneity and perfect elasticity can, however, modify theoretical stress distributions considerably. In addition, known variation of strength of rocks with volume of rock makes predictability of failure due to stress concentration questionable. Several experiments have been conducted which show that failure due to compressive stress concentrations can be predicted under favorable circumstances quite accurately. However, considering failure as a stochastic phenomenon, predictions should be in terms of probability of failure rather than certainty. As a result, it can be seen that a main requirement to improve correspondence between experimental and predicted results is to have better methods for determining mechanical properties of rock masses.—*from* Author's abstract

09976 **Coates, Donald R.** Discussion of K. M. Clayton, "Glacial erosion in the Finger Lakes Region (New York, U.S.A.)" [1965] [with French and German abs.]: Zeitschr. Geomorphologie, new ser., v. 10, no. 4, p. 469–474, 1966.

Ambiguities are pointed out in Clayton's statements (ibid., v. 9, no. 1, p. 50–62, 1965) regarding the nature of the plateau surface and magnitude of its destruction, drift thickness, and glacial fill depth. Coates agrees in part with his thesis that ice erosion could be vigorous in some valleys, but is in major disagreement concerning the valley origin, believing that drainage anomalies represent the combination of a long period of preglacial erosion followed by a series of unusual glacial, interglacial, and proglacial stream diversion channels that were repeatedly exploited by later ice movements. This multicycle theory for the Finger Lakes is based on over 10 years study of the area and interpretation of data assembled from 2,000 wells and 517 bore holes.—G.D.C.

Cochrane, T. S. *See* Muir, W. G. 10216

Coleman, N. T. *See* McNeal, B. L. 10153

Colquhoun, Donald J. *See* Paradeses, William. 09952

09968 **Colton, Roger B.; McKay, Edward J.** Geologic map of the Yucca Flat quadrangle, Nye County, Nevada: U.S. Geol. Survey Geol. Quad. Map GQ–582, scale 1:24,000, sections, 1966.

10145 **Colville, Patricia A.; Ernst, W. G.; Gilbert, M. C.** Relationships between cell parameters and chemical compositions of monoclinic amphiboles: Am. Mineralogist, v. 51, nos. 11–12, p. 1727–1754, illus., tables, 1966.

Chemical analyses of amphiboles have been collected, and variation of relatively pure members plotted on a series of eight compositional quadrilaterals; an attempt has been made to avoid lumping by distinguishing ferrous and ferric iron, magnesium and aluminum as independent chemical variables. . . . Few natural amphiboles approach pure end member compositions but evaluation of cell dimensions for synthetic amphibole end members . . . shows that replacement of magnesium by ferrous iron results in systematic unambiguous lattice parameter increases [especially in b, a sin β and c].—*from* Authors' abstract

00275 **Conolly, J. R.; Ewing, M.** Sedimentation in the Puerto Rico Trench: Jour. Sed. Petrology, v. 37, no. 1, p. 44–59, illus., tables, 1967.

A description is given of sediments that occur in the Puerto Rico Trench area. Deposits of the slope, scarps, and trench floor were sampled as cores. Sediment properties, as well as variation in bottom topography, show that strata were deposited by turbidity currents flowing from the shelf through numerous canyons northwestward down an abyssal plain and into the main trench where they spread laterally. Examples are cited of extensive fine sand deposits accumulated far out on the main trench floor and at elevations above those at which the sand entered the trench.—E.D.M.

00201 **Coombs, D. S.; Whetten, J. T.** Composition of analcime from sedimentary and burial metamorphic rocks: Geol. Soc. America Bull., v. 78, no. 2, p. 269–282, illus., tables, 1967.

The range in composition of analcimes is approximately $Na_{16}Al_{16}Si_{32}O_{96}\cdot 16H_2O$ to $Na_{13}Al_{13}Si_{35}O_{96}\cdot nH_2O$. Reaction of siliceous volcanic ash with saline waters produces silica-rich varieties whereas analcimes formed in quartz-free or low silica environments are less siliceous. Silica-poor analcimes form by direct precipitation or by clay-mineral alteration at high aqueous alkalinity and often are associated with dolomite. Metamorphic analcimes are generally of intermediate composition. Data on unit cell size versus composition are plotted.—J.J.H.

Corbett, Robert G. *See* Hall, Richard P. 00309

00224 **Cox, Allan; Dalrymple, G. B.; Doell, R. R.** Reversals of the Earth's magnetic field: Sci. American, v. 216, no. 2, p. 44–54, illus., 1967.

Accumulating evidence indicates that the Earth's magnetic field has reversed nine times in the past 3.6 m.y. It is unlikely that self-reversals could account for this

because there is little correlation between the polarity of magnetism and mineralogy for widely separated rocks, and because there is a fair correlation of reversals with the absolute ages of the rocks. The best estimate of the transition time is 5,000 years. Reversals may explain the pattern of linear magnetic anomalies adjacent to mid-ocean rises and support continental drift.—D.W.R.

00188 **Cox, E. R.** Geology and hydrology between Lake McMillan and Carlsbad Springs, Eddy County, New Mexico: U.S. Geol. Survey Water-Supply Paper 1828, 48 p., illus., table, geol. map, 1967.

Hydrology of the Pecos River valley between Lake McMillan and Carlsbad Springs is influenced by facies changes in Permian rocks. Water leaks from Lake McMillan into evaporite rocks of the Seven Rivers Formation and from Lake Avalon into carbonate rocks of the Tansill Formation. Ground-water movement is generally toward the Pecos River in valley aquifers. Chloride content of ground and surface waters indicates movement of surface water to aquifers and degree of mixing. About 45,000 acre-feet of ground water is stored in highly permeable rocks in a 3-mi wide part of the Seven Rivers Formation between Lake McMillan and Major Johnson Springs; its source is leakage from lake and from alluvium north of the springs whose flow is derived from the aquifer. Plans for increasing terminal storage are either construction of a dam or underground storage.—*from* Author's abstract

09962 **Craig, Harmon.** Isotopic composition and origin of the Red Sea and Salton Sea geothermal brines: Science, v. 154, no. 3756, p. 1544–1548, illus., table, 1966.

Deuterium and oxygen-18 measurements show that the Red Sea and Salton Sea brines are the results of a single process, the leaching of sediments by surface water circulating downward to a geothermal reservoir. The Salton Sea brine is derived from local precipitation but the Red Sea brine originates 1,000 m south of its basin, on the shallow sill which controls the circulation of the Red Sea. On this sill sea water penetrates a thick evaporite sequence to a depth of 2,000 m, and, driven by its increased density relative to sea water, flows northward to emerge in the brine-filled deeps.—Author's abstract

Crampton, Perry J. *See* Fife, Donald L. 00204

10251 **Crandall, L. LeRoy.** Foundation problems in soft soils, *in* Seminar on "The importance of the earth sciences to the public works and building official," Anaheim, Calif., 1966: Glendale, Calif., Assoc. Eng. Geologists, Los Angeles Sec., p. 351–365, illus., 1966.

The mushrooming development of small craft harbors and attendant commercial and residential areas usually involves problems with soft foundation materials. Considered here are natural deposits of soft and firm soils, the latter able to bear at least 3,000 psf of new loadings. Primary factors in the degree of foundation problem involving soft soils are: thickness and lateral extent of compacted fills to raise the grade of the site; actual physical characteristics of the underlying soft soils; stratigraphy of the soil deposits, both soft and firm, and the elevation of the water table; and character of the proposed structures and their intended usage.—G.D.C.

10328 **Crane, Jules M., Jr.** Late Tertiary radiation of viperfishes (Chauliodontidae) based on a comparison of Recent and Miocene species: Los Angeles County Mus. Contr. Sci., no. 115, 28 p., illus., tables, 1966.

The Miocene species *Chauliodus eximius* from southern California is redescribed and compared with all extant species of the genus. Postponement of the time of ossification of the anterior vertebrae in some recent species is considered as the major speciating mechanism in the late Tertiary. *Chauliodus sloani* is proposed as the first modern species to possess this characteristic. Patterns of radiation from the eastern Pacific are suggested to explain the present geographical distribution of the family.—Author's abstract

00189 **Creasey, S. C.** Geologic map of the Benson quadrangle, Cochise and Pima Counties, Arizona: U.S. Geol. Survey Misc. Geol. Inv. Map I-470, scale 1:48,000, sections, separate text, 1967.

Paleozoic rocks exposed in the Whetstone Mountains constitute a remarkably complete section and span a wider time interval than those exposed in any other range in southeastern Arizona. Except for Ordovician rocks, all Paleozoic formations of this region are represented in the mountains, either by the same formation or by a correlative equivalent. Rocks are exposed in a simple monocline, broken by a few faults that do not obscure the stratigraphic relations. The complete section of rocks (measured on east and west sides of the mountains) and the simple structure combine to produce an unexcelled reference section.—M.C.M.

00242 **Crocker, Marvin Carey, Jr.** The relationship of cation-adsorption capacity to exchange adsorption in selected feldspar minerals [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2408B, 1967.

00202 **Crook, Keith A. W.** Analyses of five analcimes from North America—Appendix, *in* Composition of analcime from sedimentary and burial metamorphic rocks: Geol. Soc. America Bull., v. 78, no. 2, p. 280–282, illus., tables, 1967.

Chemical, X-ray, and optical data are presented for one burial metamorphic vein analcime and two pyrogenic analcimes from the Crowsnest Volcanics, Alberta, one analcime from an analcimolite in the White Mud Beds, Saskatchewan, and one vein analcime from the analcimolite-bearing Lockatong Formation, Pennsylvania. The data accord with conclusions reached by Coombs and Whetten regarding the composition of sedimentary and burial metamorphic analcimes.—Author's abstract

00243 **Cuffey, Roger James.** The bryozoan species *Tabulipora carbonaria* in the Wreford megacyclothem (Lower Permian) in Kansas [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2408B–2409B, 1967.

00119 **Currie, K. L.** Shock metamorphism in the Carswell circular structure, Saskatchewan, Canada: Nature, v. 213, no. 5071, p. 56–57, illus., 1967.

Petrographic features believed to be diagnostic of hypervelocity impact occur in the Carswell structure, but in circumstances which cast doubt on the meteor impact theory. If the structure is a meteor scar, either maximum shock pressures were low in the Athabaska formation and increased abruptly in the underlying basement, or impact took place before the Athabaska sandstone formed and the glass-bearing breccias developed afterward. Neither view is accepted. The phenomenon can be explained by a model which attributes shock metamorphic effects to terrestrial processes; or perhaps identical criteria can be produced by causes other than shock pressure.—D.B.V.

Dahl, Gardar G., Jr. *See* Gilmour, Ernest H. 09949

Dalrymple, G. B. *See* Cox, Allan. 00224

10168 **Daniels, R. B.; Nettleton, W. D.; McCracken, R. J.; Gamble, E. E.** Morphology of soils with fragipans in parts of Wilson County, North Carolina: Soil Sci. Soc. America Proc., v. 30, no. 3, p. 376–380, illus., tables, 1966.

Fragipan horizons in soils in parts of North Carolina are independent of changes in texture of the overlying or underlying horizons, feldspar content, and the amount of very fine sand or silt. The coarsest textured part of the fragipan horizons are the brittle, dense areas. The brittle materials occur in the same horizon with friable, less dense, more clayey materials. The thickness, amount of brittle material, and the properties of the overlying horizons are related to soil drainage and landscape position.—Editor's brief

10143 **Daniels, Raymond B.; Jordan, Robert H.** Physiographic history and the soils, entrenched stream systems, and gullies, Harrison County, Iowa: U.S. Dept. Agriculture Tech. Bull. 1348, 116 p., illus., tables, 1966.

Cyclic erosion and sedimentation have helped determine the present landscape in Thompson Creek and Magnolia watersheds in Harrison County. The major configuration of the landscape probably was determined in pre-Wisconsin time. There have been at least five periods of alluviation on the valley floor since

deposition of the Tazewell loess, the first two requiring about 13,000 years. Each of the three periods completed in the last 2,000 years was preceded by channel trenching and valley slope erosion of the older fill; an analysis is made of causes of the gullying. The resulting geomorphic surfaces form a complex pattern on the valley slopes and floor. Discussion of the Quaternary stratigraphy includes cross sections and a list of invertebrate fossils from the De Forest Formation. Soils formed on the Tazewell are described and an appendix gives analytical data and profile descriptions.—E.S.L.

09950 **Davies, J. F.** (compiler). Metallogenic map of Manitoba: Manitoba Dept. Mines and Nat. Resources Mines Br. Map 66-2, scale 1:1,267,200, 1966.

The map legend includes symbolic representation of metals and industrial minerals, lithologic and tectonic features, and miscellaneous orogenic data—orogenic ages, serpentinite-peridotite, Precambrian inliers, and Paleozoic structures related to Precambrian basement features.—M.C.M.

Davis, G. L. *See* Hart, S. R. 00158

00171 **Davis, George H.; Meyer, Gerald.** Future of our ground water supplies: Water Well Jour., v. 21, no. 2, p. 30, 44, illus., 1967.

If data were available to calculate the unit economic value of water from surface and ground, ground water would represent a larger proportion gross withdrawals indicate. As surface water resources approach full development more use will be made of ground water. Many large cities have turned to "imported" surface water when local ground water has been overdeveloped to the point where serious side effects were threatening great damage. Increases in ground water pumpage have been noted for irrigation use east of the Rockies, overhead sprinkler systems for crops in central and eastern states, and commercial air conditioning and heating. A possible solution for ground-water storage lies in ground-water reservoirs for maximum efficiency in water development. Some engineering problems require solution before this method becomes a reality, but the real obstacle is the tangled legal situation with respect to ground-water rights.—M.C.M.

00146 **Davis, R. W.** Availability of ground water in the Melber quadrangle, Jackson Purchase region, Kentucky: U.S. Geol. Survey Hydrol. Inv. Atlas HA-174, scale 1:24,000, section, text, 1967.

Most wells in the Melber quadrangle are less than 200 feet deep and obtain water from Eocene sand. In most of the Graves County part of the area, wells should yield from 100-300 gpm. In the McCracken County part, occurrence and availability of shallow ground water are more complex because there are two aquifers: a zone perched above and a main zone of saturation below clay beds. Present withdrawals are insignificant compared to the large amount of water in storage. Quality of water is good.—M.C.M.

Dawson, Mary R. *See* Black, Craig C. 09975

10133 **Deer, W. A.; Howie, R. A.; Zussman, J.** An introduction to the rock-forming minerals: New York, John Wiley and Sons, 528 p., illus., tables, 1966.

This is a university textbook edition of the authors' five-volume work on rock-forming minerals, and is divided into five parts: ortho- and ring, chain, sheet, and framework silicates, and non-silicates. The structure, chemistry, optical and physical properties, distinguishing features, and paragenesis of each of the minerals is discussed. Sections on structure contain many diagrams; those on chemistry cover major atomic replacements, and phase equilibria. Variations of the optical and physical properties with chemistry are discussed and illustrated with graphs. Tabulated data and optic orientation sketches are included at the head of each mineral section. Some minerals have been added that were not in the original volumes, and some data and concepts are revised in the light of recent research.—E.S.L.

Deere, Don U. *See* Reyes, Salvador F. 10206

09955 **Deju, Raul A.; Bhappu, Roshan B.** A chemical interpretation of surface phenomena in silicate minerals: New Mexico Bur. Mines and Mineral Resources Circ. 89, 13 p., illus., 1966.

The oxygen–silicon ratio for a representative series of silicate minerals is correlated with their degree of adsorption when immersed in water. Experiments prove that there is a corresponding increase in adsorption with increasing O/Si ratio. The behavior of the minerals in an electric field is investigated using zero point of charge as a parameter. A theoretical model has been developed to explain the increase in zero point of charge with increasing O/Si ratio. A comprehensive bibliography on electrokinetic properties of silicates is included.—*from* Authors' abstract

10022 **delaTorre Robles, Jorge.** Clay mineral distribution in recent sediments from the North Pacific coast of Mexico [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1980B–1981B, 1966.

delCampo, Alejandro. *See* Serafim, J. Laginha. 00196

00244 **Denison, Rodger Espy.** Basement rocks in adjoining parts of Oklahoma, Kansas, Missouri, and Arkansas [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2409B, 1967.

00301 **Dennison, John M.; Travis, Jack W.; Ferguson, James H.** Kittlelick Thrust—A new fault in Mineral and Grant Counties, West Virginia: West Virginia Acad. Sci. Proc. 1966, v. 38, p. 177–185, illus., 1967.

The Kittlelick fault, cropping out for 12 mi along the base of the Allegheny front, dips approximately 46° S. 62° E. and is confined to the Brallier Formation. Up to 1,340 feet of stratigraphic displacement is estimated, with maximum dip-slip displacement of approximately 1,900 feet. The fault is interpreted as a branch from the decollement, which underlies the Ridge and Valley and the Appalachian Plateau provinces. Segments of Allegheny Front with different tectonic behavior along strike are related to structural blocks which Gwinn (1964) delimited in the Appalachian Plateau. These blocks have different tectonic characteristics above the sole fault, and they apparently are manifested along Allegheny Front as zones with different amounts of faulting.—*from* Authors' abstract

Denny, Marion V. *See* Johnson, Stanley S. 10290

10116 **deWaard, D.** On water–vapor pressure in zones of regional metamorphism and the nature of the hornblende–granulite facies: Koninkl. Nederlandse Akad. Wetensch. Proc., ser. B, v. 69, no. 4, p. 453–458, illus., 1966.

The boundary reaction between almandite–amphibolite facies and pyroxene–granulite facies appears as a dehydration curve on a P_w–T diagram, the hornblende–granulite facies representing univariant equilibrium in systems with excess H_2O and divariant in H_2O–deficient systems. A divariant field may be constructed between the minimum and maximum P_f–T conditions to represent the stability field after estimating distribution in zones of an orogenic belt during regional metamorphism. In the uppermost zone, P_w is less than P_f; in the epizone and mesozone, equal to P_f; and in the katazone exceeds P_w. The high ratio of hornblende–granulite facies assemblages in granulite facies terranes may result from closed H_2O–deficient systems giving rise to P_f–T intervals where reactants and products may coexist.—E.S.L.

10221 **deWaard, D.** The biotite–cordierite–almandite subfacies of the hornblende–granulite facies: Canadian Mineralogist, v. 8, pt. 4, p. 481–492, illus., table, 1966.

The assemblages quartz–K feldspar–plagioclase–sillimanite–cordierite–biotite–almandine and quartz–K feldspar–plagioclase–cordierite–biotite–almandine–hypersthene characterize a newly established biotite–cordierite–almandine subfacies of the hornblende–granulite facies. The two typomorphic reactions are:

biotite + sillimanite + quartz = cordierite + almandine + orthoclase + H_2O, and biotite + quartz = cordierite + almandine + orthopyroxene + orthoclase + H_2O. The subfacies forms the lower P_{total} (or higher T) portion of the hornblende–granulite facies.—E.Z.

00163 **Dibblee, T. W., Jr.** Geologic map of the Broadwell Lake quadrangle, San Bernardino County, California: U.S. Geol. Survey Misc. Geol. Inv. Map I–478, scale 1:62,500, sections, separate text, 1967.

The text contains a description of map units: Cenozoic sedimentary and volcanic rocks, Mesozoic and older(?) plutonic igneous rocks, and pre–Mesozoic metamorphic rocks; and descriptions of manganese, gold–copper, and perlite mines and prospects.—M.C.M.

10179 **Dicke, R. H.** The secular acceleration of the Earth's rotation and cosmology, *in* The Earth–Moon system—Internat. Conf., Goddard Space Flight Center, NASA, 1964, Proc.: New York, Plenum Press, p. 98–164, illus., tables, 1966.

Astronomical measurement of the secular acceleration of the Earth's rotation is discussed, and the various geophysical factors affecting this rotation are investigated. Data from five different total eclipses are combined with information obtained telescopically in the past two centuries to calculate five different average accelerations of the Earth's rotation. Results are given in tables. An explanation for the paradoxical residual in the rotational acceleration in terms of a secular decrease in gravitational constant, the effect of interaction with a zero mass scalar field, may be correct; however, geophysical explanations—core–mantle coupling fluctuations, angular momentum transfer to solar wind, atmosphere, or oceans, continental unrest, growth of core, etc.—cannot be excluded. Ten geophysical by–products of the investigations are listed.—V.S.N.

09994 **Dickinson, Arthur S.** Paleo–structural analysis and application of later structural tilting [abs.]: Houston Geol. Soc. Bull., v. 9, no. 3, p. 15, 1966.

09985 **Dietz, Robert S.** Shatter cones at the Middlesboro structure, Kentucky: Meteoritics, v. 3, no. 1, p. 27–29, 1966.

Shatter cones have been discovered in two residual boulders in the central uplift eye of the Middlesboro structure, Kentucky. This finding gives additional support to the interpretation of Englund and Roen (1962) that this is probably an astrobleme, i. e., an ancient meteorite impact scar.—Author's abstract

09986 **Dietz, Robert S.** Striated surfaces on meteorites—Shock fractures, not slickensides: Meteoritics, v. 3, no. 1, p. 31–33, 1966.

Veined and brecciated chondrites commonly display striated fractures which have been interpreted as slickensides (fault dislocations). Observations on several such fractures in various collections suggest that they are not true slickensides but, instead, are probably shock features related to shatter coning.—Author's abstract

00194 **Dilcher, D. L.; McQuade, J. F.** A morphological study of *Nyssa* endocarps from Eocene deposits in western Tennessee: Torrey Bot. Club Bull., v. 94, no. 1, p. 35–40, illus., 1967.

Several nearly unaltered endocarps of *Nyssa* were found in Eocene sediments of the Mississippi embayment [Henry County]; the morphology was studied in detail. These newly found endocarps are related to compressed *Nyssa* endocarps previously reported from the Eocene sediments of the Mississippi embayment and to the nyssas found in the Brandon lignite deposits. *Nyssa wilcoxiana* Berry is put in synonymy with *N. eolignitica*.—*from* Authors' abstract

Dodd, Jerry S. *See* Anderson, H. Walter, 10212

10122 **Dodd, P. H.; Droullard, R. F.** A logging system and computer programme to determine rock density of uranium deposits [with French, Russian, Spanish abs.], *in* Radioisotope instruments in industry and geophysics—A symposium, Warsaw,

1965, Proc., V. 2: Vienna, Austria, Internat. Atomic Energy Agency, p. 205–224, illus., 1966.

Bulk density of uranium ores and associated rocks is determined from boreholes using a slim-hole nuclear logging system and computer interpretation program. For density measurements, the system consists of a gamma-gamma density probe and a caliper probe and associated system; an integrating digital voltmeter serves as a BCD conversion unit for nuclear pulse and analog caliper data. Output data on perforated tape are converted to cards, control cards containing calibration and correction constants are added, and data are edited and submitted for interpretation by computer. Bulk density is determined from a second order polynomial equation relating difference in count rate between long- and short-spaced detectors to bulk density. RHOLOG, a FORTRAN program for IBM 7090 computer, correlates logging, calibration, and correction data, and calculates bulk densities.—*from* Authors' abstract

Doell, R. R. *See* Cox, Allan, 00224

Donnay, Gabrielle. *See* Donnay, J. D. H. 00216

00216 **Donnay, J. D. H.; Donnay, Gabrielle.** Optical determination of water content in spherulitic vaterite: Acta Cryst., v. 22, pt. 2, p. 312–314, illus., 1967.

From measured indices of refraction for vaterite crystals [$n_{epsilon}$ 1.650, n_{omega} 1.550; Johnston, Merwin and Williamson, *Amer. J. Sci.* 41, 473 (1916)] and for vaterite fibers [n_{γ} 1.625, n_{β} 1.538; Meyer, *Z. Kristallogr.*, 121, 220, (1965)], Wiener's formulae give two independent values for the interstitial water content of the fibers (5.9, 5.8 vol. percent). The lowering of the density from 1.645 (crystal) to 1.54 (fiber) indicates 6.4 vol. percent water. The decomposition product of $CaCO_3 \cdot 6H_2O$ described by Johnston *et al.* can now be identified as fibrous aggregates of vaterite and water.—Authors' abstract

10080 **Dorr, John A., Jr.** Wind-polished stones—Two similar sites: Michigan Acad. Sci., Arts and Letters Papers 1965, v. 51, p. 265–273, illus., 1966.

Highly polished surfaces on gastrolith-like stones have been seen at Franklin Bluffs in northern Alaska where the Tertiary Sagavanirktok Formation forming the bluff contains fine sandstone and siltstone below and conglomerate above, all loosely cemented; and on a west-facing bluff along Fisherman Creek in the Hoback basin of Wyoming where the Tertiary Pass Peak Formation has the same type of strata. Winds are funneled up the valley and blow forcefully against the bluffs. It is concluded that most "gastroliths" owe their high polish to wind action and that no rounded, highly polished stones should be identified as gastroliths unless found within a fossilized skeleton.—E.S.L.

00212 **Drake, Avery Ala, Jr.; Epstein, Jack B.** The Martinsburg Formation (Middle and Upper Ordovician) in the Delaware Valley, Pennsylvania-New Jersey: U.S. Geol. Survey Bull. 1244-H, p. H1–H16, illus., 1967.

Detailed mapping of ten 7 1/2-minute quadrangles in eastern Pennsylvania and western New Jersey has shown that the Martinsburg Formation of Middle and Late Ordovician age can be divided into three members: a lower thin-bedded slate, a middle graywacke-bearing unit, and an upper thick-bedded slate. These units are herein named the Bushkill, Ramseyburg, and Pen Argyl Members, respectively. The Pen Argyl Member is buried east of the Delaware River and west of Kempton, Pa., near the Schuylkill River because of unconformable overlap by the superjacent Shawagunk Conglomerate of Silurian age. At the present time, commercial slate is quarried only in the Pen Argyl Member and the upper part of the Ramseyburg Member.—A.A.D.

Droullard, R. F. *See* Dodd, P. H. 10122

10074 **Dugas, Jean.** The relationship of mineralization to Precambrian stratigraphy in the Rouyn-Noranda area, Quebec [with French abs.], *in* Precambrian symposium—The relationship of mineralization to Precambrian stratigraphy in

certain mining areas of Ontario and Quebec: Geol. Assoc. Canada Spec. Paper 3, p. 43–55, illus., 1966.

The base metal deposits, mainly represented by massive sulfide bodies, are all associated with volcanic rocks, and bear a close relationship to the stratigraphy. They occur in the same volcanic group and are mostly found at contacts. A thin bed of mineralized cherty tuff, representing relative quiescence, is generally present at the favorable contacts. A zone of intense mineral alteration, generally pipe-like in shape, underlies most of the bodies. Mineralization above the ore bodies is generally poor. It is suggested that the intrusive rocks are post-ore. The gold deposits are later, some related to the Flavrian and Powell granites, others to the Cadillac and subsidiary faults, or the Destor-Porcupine fault. These faults follow weak zones between the sedimentary and volcanic rocks. Minor copper-nickel mineralization is related to intermediate to ultrabasic intrusive rocks.—*from* Author's abstract

00234 **Dunlap, Wayne Alan.** Deformation characteristics of granular materials subjected to rapid, repetitive loading [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2344B–2345B, 1967.

10182 **Eakin, Thomas E.; Lamke, Robert D.; Everett, D. E.** Hydrologic reconnaissance of the Humboldt River basin, Nevada: Nevada Dept. Conserv. and Nat. Resources Water Resources Bull. 32, 107 p., illus., tables, 1966.

The Humboldt River basin, nearly 17,000 sq mi in the Basin and Range province, is divided into three general units (upper, middle, lower). The complicated structural history of the region affects the hydrologic regimen, but the full effect is not entirely known. Locally faulting impedes ground-water movement, but elsewhere faulting may result in fracturing the adjacent rocks, which in turn aids in transmitting water. The Cenozoic structural events have a dominant influence on occurrence and movement of water. Quaternary deposits together with Tertiary sedimentary and volcanic rocks function collectively as ground-water storage units. Locally in the upper basin and in higher valleys in the middle basin, Quaternary deposits may be absent or above the saturation zone; there ground-water occurs principally in Tertiary valley-fill deposits. There are great variations in chemical quality of the water.—M.C.M.

Eckhoff, Oscar B. *See* Johnson, G. Leonard, 10315

00223 **Eglinton, Geoffrey; Calvin, Melvin.** Chemical fossils: Sci. American, v. 216, no. 1, p. 32–43, illus., 1967.

The authors review many problems of organic geochemistry from extraction and identification of compounds to problems of contamination and chemical versus biological evolution. They conclude that sediments as old as the Fig Tree System in Swaziland, Africa (3.1 b.y. old) contain alkanes (isoprenoid molecules) clearly related to long chain carbon compounds of present day organisms. Contamination, if it occurred, took place before lithification and could not change the age of the compound by more than a few 10 m.y. Nonbiological processes are extremely unlikely to produce those specific isoprenoid patterns found in the products of living cells.—D.W.R.

00245 **El-Ashry, Mohamed Taha.** Photointerpretation of shoreline changes in selected areas along the Atlantic and Gulf Coasts of the United States [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2409B–2410B, 1967.

00150 **Ellis, Brooks F.; Messina, Angelina R.** Catalogue of index Foraminifera, V. 3: New York, Am. Mus. Nat. History, [680] p., illus., 1967.

Index species (160 in all) of the genera *Asterocyclina, Athecocyclina, Discocyclina, Properocyclina, Pseudophragmina, Archaecyclus, Lepidorbitoides, Omphalocyclus, Orbitoides, Torreina, Sulcoperculina, Spiroclypeus, Pseudorbitoides, Sulcorbitoides, Vaughanina*, and nine related genera, are herein catalogued, with illustrations and bibliographic references. These larger Foraminifera are discoidal, lenticular, and star-shaped forms of the families Discocyclinidae, Orbitoididae, Nummulitidae, and

Pseudorbitoididae (suborder Rotaliina). They are index fossils for the Upper Cretaceous and Tertiary (Paleocene–Miocene) of the Old and New Worlds.—V.M.J.

10195 **Ellis, Brooks F.; Messina, Angelina R.** Catalogue of index Foraminifera, V. 2: New York, Am. Mus. Nat. History, [746] p., illus., 1966.

Index species of the genera *Nummulites, Assilina, Orbitolina, Coskinolina, Coskinoloides, Dictyoconoides, Dictyoconus, Eodictyoconus, Kilianina, Lituonella, and Lockhartia*, are herein catalogued, with illustrations and bibliographic references, under the names (189 in all) used by each author, with junior synonyms so indicated. These larger Foraminifera are discoidal and conoidal forms of the families Nummulitidae, Rotaliidae, and Cymbaloporidae (suborder Rotaliina); and the families Pavonitinidae and Orbitolinidae (Textulariina, Lituolacea). They are index fossils for the Middle and Upper Jurassic, Lower and Upper Cretaceous, and Tertiary (Paleocene–Miocene) of the Old and New Worlds.—V.M.J.

Ellis, Robert M. *See* Vozoff, Keeva. 10097

Emery, K. O. *See* Uchupi, Elazar. 00167

Empson, F. M. *See* Bradshaw, R. L. 10192

10204 **Emrich, Grover H.** Ironton and Galesville (Cambrian) Sandstones in Illinois and adjacent areas: Illinois Geol. Survey Circ. 403, 55 p., illus., tables, 1966.

Cambrian sediments in the Upper Mississippi Valley were deposited on a broad stable shelf forming a sequence of uniform, widespread, largely clastic units within which the Ironton and underlying Galesville Sandstones form an important source of ground water throughout northern Illinois and southeastern Wisconsin. The two sandstones are mature, well sorted orthoquartzites. Cross-bedding is common; in the Galesville, orientation is to the southwest with local variation; in the Ironton it is to the east in western Wisconsin but to the southwest elsewhere. The sandstones form the most consistently permeable and productive aquifer in the area; transmissivity decreases from north to south as carbonate content increases. Despite many years of heavy pumping, potable water under high artesian head is widely available.—*from* Author's abstract

Epstein, Jack B. *See* Drake, Avery Ala, Jr. 00212

10094 **Ergun, Sabri.** Determination of longitudinal and transverse optical constants of absorbing uniaxial crystals—Optical anisotropy of graphite: Nature, v. 213, no. 5072, p. 135–136, table, 1966.

Equations relating the minimum values of the refractive and attenuation indices to the longitudinal and transverse optical constants are developed. The longitudinal optical constants of graphite are thus obtained.—Author's abstract

Ernst, W. G. *See* Colville, Patricia A. 10145

10249 **Evans, Dennis A.** Pre-construction design against landslides, *in* Seminar on "The importance of the earth sciences to the public works and building official," Anaheim, Calif., 1966: Glendale, Calif., Assoc. Eng. Geologists, Los Angeles Sec., p. 246–314, illus., 1966.

Emphasis here is on analysis of slope stability in realistic terms that can be understood by the engineer and public official, on the need to explain some classic geologic terminology, and on the fact that slope stability and landslides can be predetermined. All slopes are not hazardous, few, if any, are stable in an absolute sense, and whether man-made cut or fill, or natural, each is a problem unto itself. Variability dictates probability of error in the determination of underlying geologic structure, physical or engineering properties of rock or soil, and external forces affecting the slope. Landsliding is frequently caused by some temporary external force such as seismic load on a slope which otherwise would not have failed. A sample analysis of geologic planes of weakness in a discontinuum shows the usefulness of the equal area projection method.—G.D.C.

Evans, R. D. *See* Swain, F. M. 00273

Everett, D. E. *See* Eakin, Thomas E. 10182

00130 **Evitt, William R.** Five compilations of the literature on organic-walled fossil microplankton: Micropaleontology, v. 13, no. 1, p. 111–114, table, 1967.

Five reference works on fossil microplankton of interest to palynologists are described and compared.—Author's abstract

Ewing, M. *See* Conolly, J. R. 00275

10090 **Faas, Richard W.** Paleoecology of an arctic estuary [with French and Russian abs.]: Arctic, v. 19, no. 4, p. 343–348, illus., 1966.

An alternating sequence of black silt and clay units, and coarse sand and gravel units, has been found to depths of 30 feet below sea level in the sediments underlying an arctic estuary [Nerravak (Esatkuat) Lagoon, Alaska]. The black silt and clay units, containing pitted foraminiferal tests, were deposited in an anaerobic environment while the estuary was isolated from the ocean by a gravel bar across its mouth. The sand and gravel units, containing pelecypod fragments, resulted from the destruction and spreading of the gravel bar inland under marine conditions. A radiocarbon date at the base of the sequence indicates these conditions first occurred 6,450 years ago.—Author's abstract

00285 **Fagerstrom, J. A.** Development, flotation, and transportation of mud crusts—Neglected factors in sedimentology: Jour. Sed. Petrology, v. 37, no. 1, p. 73–79, illus., 1967.

Mud crusts are the semi-indurated, loosely attached, upper laminae of crack bounded mud polygons. Factors influencing sizes and shapes of crusts include blue-green algal mats. In warm waters of high pH, rapidly growing algal filaments penetrate the muds to trap and bind sediment. Dried algae increase mud cohesion and crusts maintain their integrity with rewetting. Bubbles of photosynthetically produced oxygen from algal mats below crusts may cause flotation of crusts, which may then be transported by currents. Upon dissipation of the supporting bubble layer, the crusts sink and may become tabular constituents of edgewise conglomerates and intraformational conglomerates and breccias, some as units of entirely conformable rock sequences.—E.J.C.

Faig, W. *See* Konecny, G. 10089

10261 **Feld, J.** The factor of safety in soil and rock mechanics [with French summ.], *in* Internat. Conf. Soil Mechanics and Found. Eng., 6th, Montreal, 1965, Proc., V. 3: Toronto, Ontario, Univ. Toronto Press, p. 185–197, illus., table, 1966.

In soil and rock foundation problems safety must be provided to adjacent structures as well as the one being designed or constructed. The criterion of safety is more often a limit of deformation or settlement than of stress. There are hidden dangers in possible deficiencies stemming from sample or *in situ* testing of strength, from empirical methods of analysis, and from constructional procedures. A chain reaction of failure due to relatively small oversights can easily occur. Time-dependent degradation of strengths must be considered in the design. This applies to soils affected by changes in loads and moisture content as well as to rocks affected by unloading in excavations, by plastic flow when lateral support is removed, and by aging. Any factor of safety must be assessed on the reliability of subsoil information, on non-conformity of test samples with actual ground condition, and on the possibility of vibration effects.—G.D.C.

10217 **Feld, Jacob.** Age change in bearing capacity of mica schist [with French and German abs.], *in* Internat. Soc. Rock Mechanics Congress, 1st, Lisbon, 1966, Proc., V. 2: Lisbon, Portugal, Laboratório Nacional Engenharia Civil, p. 523–524, 1966.

Exposures of Manhattan Schist in New York City supporting loads up to 20 tons per sq ft show loss of crystalline structure and changes in elastic properties with

time. The time required for such changes is surprisingly short; under superimposed loadings of approximately 25 tons per sq ft, physical changes occur in 10 to 20 years. The altered rock is unsafe as a foundation only where cavities or seams occur. When lateral support is removed, however, serious loss in bearing capacity may occur. Various examples encountered in subway, bridge, and other constructions are cited.—V.S.N.

Ferguson, James H. *See* Dennison, John M. 00301

10119 **Ferguson, S. A.** Geology of Dome township, District of Kenora: Ontario Dept. Mines Geol. Rept. 45, 98 p., illus., tables, geol. map, 1966.

Dome Township is in the central part of the gold-mining area at Red Lake. The two mines now in operation produced 1,491,975 oz of gold and 207,608 oz of silver from 1935–1962. Precambrian rocks consist of metabasalt, acid to intermediate welded tuff, and sedimentary rocks, intruded by a variety of dikes, sills, and plugs, with the Dome and McKenzie Island stocks the major granitic intrusions. Analyses are given for quartz latites, the Wilmar plug, and Dome and McKenzie Island stocks. Pleistocene history is reviewed. Magnetic contours are included on the geologic map, and a gravity survey was run to determine the distribution of the Keewatin greenstones at depth. Half of the report is devoted to economic geology, comprising descriptions of the properties.—E.S.L.

10076 **Ferguson, Stewart A.** The relationship of mineralization to stratigraphy in the Porcupine and Red Lake areas, Ontario [with French abs.]. *in* Precambrian symposium—The relationship of mineralization to Precambrian stratigraphy in certain mining areas of Ontario and Quebec: Geol. Assoc. Canada Spec. Paper 3, p. 99–119, illus., tables, 1966.

Early Precambrian rock sequences in Red Lake and Porcupine areas both consist of three major types: metabasalt, acidic welded tuff, and sedimentary rocks. At Red Lake sedimentary rocks comprise greywacke and argillite with conglomerate beds high in the sequence. In the Porcupine area older sedimentary rocks are unconformably overlain by younger conglomerate, greywacke, quartzite, and argillite. Intrusive suites both are similar, ranging from early basic and ultrabasic to later intermediate and acid rocks. New information has been added on type, thickness, continuity, and relative ages of major rock units. Similar rock types in similar sequences indicate rhythmic volcanic-sedimentary cycles. Known copper mineralization of economic grade is restricted to the Pearl Lake Porphyry in the Porcupine area; gold orebodies occur in a variety of rock types.—*from* Author's abstract

00246 **Ferrell, Ray Edward, Jr.** Structural aspects of clay mineral alterations [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2410B, 1967.

00204 **Fife, Donald L.; Minch, John A.; Crampton, Perry J.** Late Jurassic age of the Santiago Peak Volcanics, California: Geol. Soc. America Bull., v. 78, no. 2, p. 299–303, illus., 1967.

Prebatholithic rocks in western San Diego County, Calif., are metamorphosed volcanic and volcanically derived sedimentary rocks of Triassic to Jurassic age called the Santiago Peak Volcanics. Fossils in argillite, graywacke, and slate interbeds include *Buchia piochii*, belemnoids, and unidentified forms. A Late Jurassic (Portlandian) age is indicated.—J.P.A.

09974 **File, Lucien; Northrop, Stuart A.** County, township, and range locations of New Mexico's mining districts: New Mexico Bur. Mines and Mineral Resources Circ. 84, 66 p., illus., 1966.

This list of locations of New Mexico mining districts by county, township and range, includes a brief history of the naming of districts, with an appendix of highlights in the development of the State's mineral resources.—M.S.T.

09967 **Finch, Warren I.** Geologic map of the Paducah West and part of the Metropolis quadrangles, Kentucky–Illinois: U.S. Geol. Survey Geol. Quad. Map GQ–557, scale 1:24,000, sections, text, 1966.

Coastal plain sand and clay formations of Upper Cretaceous to Eocene age are largely covered by surficial continental deposits, loess, and alluvium of Pliocene(?) to Recent age. Gravel from the extensive continental deposits is used for road metal. Sand is used for foundation fill. Clay has been used for fuller's earth and pottery, and results of tests given for one sample of clay indicate possible use for lightweight aggregate. Ground water is obtained from gravel in the continental deposits and from sand in Eocene and older formations. X-ray analyses are given for clay samples from each map unit. Fossil pollen, gastropod, and pelecypod assemblages are reported. Sections across the Ohio River show alluvium to be much thinner than indicated in previous reports dealing with the area.—W.I.F.

10193 **Finn, W. D. Liam.** Static and dynamic stresses in slopes [with French and German abs.]. *in* Internat. Soc. Rock Mechanics Congress, 1st, Lisbon, 1966, Proc., V. 2: Lisbon, Portugal, Laboratório Nacional Engenharia Civil, p. 167–169, illus., 1966.

The change in the initial stress pattern in rock due to loading or excavation is investigated by the finite element method of analysis of Clough (1965). Dynamic stresses caused by an earthquake are analyzed by solution of the equations of motion of the nodal points, reduced to n normal equations, using the step-by-step matrix analysis method in integration of Wilson and Clough (1962). An example is given from the Alameda Park, Mexico City, earthquake of May 11, 1962.—V.S.N.

00219 **Finnell, Tommy L.; Bowles, C. Gilbert; Soulé, John H.** Mineral resources of the Mount Baldy primitive area, Arizona: U.S. Geol. Survey Bull. 1230–H, p. H1–H14, illus., table, 1967.

The Mount Baldy primitive area in the Apache National Forest is apparently barren of mineral deposits. It is underlain by about 3,500 feet of volcanic flows and as much as 450 feet of glacial drift; volcanic rocks are mainly andesite porphyry, basalt, and basaltic scoria and tuff beds, glacial drift mainly rock fragments derived from volcanic rocks. Samples of most bedrock units and stream sediments were analyzed by semiquantitative spectrographic and chemical methods; results show metal content to be low and possibility of commercial deposits of metallic ores remote. Of doubtful value are: a small cinder cone that might yield road-metal material, but which is too small and inaccessible; Coconino Sandstone which may be present at depth beneath the White Mts., but existence of structural traps is conjectural; and coal, probably of low grade, thin, and too far below the surface.—*from* Authors' abstract

10115 **Fischer, Irene.** Gravimetric interpolation of deflections of the vertical by electronic computer: Bull. Géod., no. 81, p. 267–275, illus., 1966.

The U.S. Army Map Service is in the process of revising its chart of geoidal contours for North America, using a closely spaced meridional profile through the middle of the country as a backbone for the construction. For this purpose astrogeodetic deflections are being interpolated by gravimetrically computed deflections, to provide close spacing. The method used, which involves a computer, is described.—D.B.V.

10156 **Fisher, D. Jerome.** Cacoxenite from Arkansas: Am. Mineralogist, v. 51, nos. 11–12, p. 1811–1814, tables, 1966.

In the Ouachita Mts., cacoxenite occurs as fracture fillings in novaculite. It consists of radiating globular masses up to 6 mm in diameter of narrow acicular golden-yellow needles. The indices are $\omega = 1.600$ and $\epsilon = 1.680$. Indexed X-ray powder diffraction data are given.—B.S.H.

10329 **Fitch, John E.** Additional fish remains, mostly otoliths, from a Pleistocene deposit at Playa del Rey, California: Los Angeles County Mus. Contr. Sci., no. 119, 16 p., illus., tables, 1966.

When the washed screenings from a 200-pound field sample of fossiliferous "dirt" from the Playa del Rey locality (LACMIP 59) were examined a spoonful at a time with the aid of a microscope, 1,174 identifiable otoliths (representing 34 "species") were recovered. Twelve of these species were new to the deposit, as were two of the elasmobranchs from which teeth were found. The yield of fish remains "from this resampling experiment" emphasizes the necessity for using a microscope or similar viewing aid for obtaining accurate information on the fauna contained in a fossil deposit.—Author's abstract

00235 **Flaate, Kaare Sigfred.** Stresses and movements in connection with braced cuts in sand and clay [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2345B, 1967.

10231 **Flawn, Peter T.** Geology and urban development, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 209–213, 1966.

Geological considerations important in the development of a city are considered under resources and municipal engineering. Critical resources are water and construction materials. City planning is necessary to harvest the sand and gravel or stone before making the land available for building, and for this geologic maps are necessary. Most cities do not have such maps, nor do they hire geologists. Without adequate geologic knowledge, foundations for buildings, bridges, and dams, and the digging of tunnels, may fail, or costs may be very high. An accurate large-scale geologic map must be kept up-to-date and will save enough in engineering costs to pay for itself.—E.S.L.

10128 **Fleischer, Michael.** Rare earths in the aeschynite-priorite series—The status of lyndochite: Mineralog. Mag., v. 35, no. 274, p. 801–809, illus., tables, 1966.

Data on the contents of individual rare earths are summarized for 24 members of the aeschynite-priorite series and 3 lyndochites. It is shown that the data are in accord with the assignment of lyndochite to the aeschynite-priorite series. The available X-ray data are not definitive, but indicate at least strong similarity of lyndochite to aeschynite; the classification of lyndochite as a variety of euxenite is excluded.—Author's abstract

00114 **Fleischer, R. L.; Price, P. B.; Walker, R. M.; Maurette, M.** Origins of fossil charged-particle tracks in meteorites: Jour. Geophys. Research, v. 72, no. 1, p 331–353, illus., tables, 1967.

Possible origins of naturally occurring charged-particle tracks in meteorites are considered. Meson jets and magnetic monopoles are probably not important. The four other possible sources—slowed-down heavy cosmic-ray primaries, spontaneous fission of U-238 and extinct Pu-244, induced fission of heavy elements by cosmic rays, and spallation recoils—are shown to produce characteristic track features that allow the dominant source to be uniquely identified in individual meteorites. Two important applications of fossil meteoritic tracks are the determination of the abundance of extremely heavy cosmic rays and the measurement of the cool-down time of bodies in the early solar system.—D.B.V.

00115 **Fleischer, R. L.; Price, P. B.; Walker, R. M.; Maurette, M.; Morgan, G.** Tracks of heavy primary cosmic rays in meteorites: Jour. Geophys. Research, v. 72, no. 1, p. 355–366, illus., tables, 1967.

Tracks of primary cosmic rays with atomic number about 20 or higher have been identified in 23 out of 42 meteorites. The original depths of the samples below the preatmospheric surfaces of the meteoroids were found to range from about 3 to 50 cm. Minimum values of the preatmospheric radii ranging from 10 to 55 cm were also obtained. The observed distribution of track lengths was used to infer the existence of cosmic rays that are considerably heavier than iron. The relative abundance of cosmic rays with atomic number of about 32 or higher was estimated to be about 1:4,000 that of the iron group (20–30).—D.B.V.

00296 **Flores, Romeo M.** Variations in mineral composition during transport: Jour. Sed. Petrology, v. 37, no. 1, p. 235–239, illus., tables, 1967.

Proportions of detrital quartz, feldspar, and mica, in the Lower Freeport sandstone of the Pennsylvanian Allegheny Group in Ohio, show no progressive change which can be related to effects of approximately 100 miles of transport. All significant variation is a function of grain size. Regional direction of transport to the north–northeast is interpreted from measured orientations of sedimentary structures.—R.A.C.

00278 **Foster, Roy W.** Geology and petroleum possibilities of west-central New Mexico [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 51, no. 1, p. 167, 1967.

Fowler, Gerald A. *See* Byrne, John V. 10009

10053 **Frankforter, W. D.** Some recent discoveries of late Pleistocene fossils in western Michigan: Michigan Acad. Sci., Arts and Letters Papers 1965, v. 51, p. 209–220, illus., tables, 1966.

Late Pleistocene age fossil discoveries reported are the right ramus of *Ursus americanus*, the partial skull of *Symbos cavifrons*, a left upper third molar of *Mammut americanum*, and a partial tooth of *Mammuthus jeffersoni*. The bear specimen was found during dredging at Big Wabasis Lake, Kent County, the muskox specimen in a marl pit in Newaygo County, the mastodon tooth in a drainage ditch in Kent County, and the mammoth tooth in a gravel pit in Ferrysburg. All are described and the larger specimens illustrated.—E.S.L.

10242 **Frankian, R. T.** Role of the soil engineering investigation, *in* Seminar on "The importance of the earth sciences to the public works and building official," Anaheim, Calif., 1966: Glendale, Calif., Assoc. Eng. Geologists, Los Angeles Sec., p. 7–19, 1966.

Soil mechanics has lagged behind the development of other phases of structural engineering for several reasons, among which are the long held opinion that foundations are only a necessary evil, and a general lack of understanding of the difference between the behavior of soils and other construction materials. Because of the variability of soils, building officials should require soil investigation for unusual structures or for sites in areas for which there is no record of experience, rather than rely on existing building code values.—Author's abstract

00190 **Fraunfelter, George H.** The stratigraphy of the Cedar City Formation (Middle Devonian) of Missouri: Illinois Acad. Sci. Trans., v. 60, no. 1, p. 9–44, illus., tables, 1967.

The Middle Devonian strata of central and northeastern Missouri, formerly assigned to the Callaway Formation which embraced the Cooper Limestone Facies and the Callaway Limestone Facies, are assigned to the Cedar City Formation (new name). The names Cooper and Callaway are retained to designate the lithofacies of the Cedar City Formation. The Cooper Lithofacies is divided into seven physiofacies and the Callaway Lithofacies is divided into four physiofacies. The various physiofacies interfinger with one another and each is defined and described. [Detailed measured sections and faunal lists of both lithofacies are included].—*from* Author's abstract

10070 **Friedman, Gerald M.; Johnson, Kenneth G.** The Devonian Catskill deltaic complex of New York, type example of a "tectonic delta complex," *in* Deltas in their geologic framework: Houston, Tex., Houston Geol. Soc., p. 171–188, illus., 1966.

This paper briefly reviews the geology of the Catskill deltaic complex, restates the concepts of Barrell, and contrasts the Catskill deltaic plain with that of some modern deltas. In the constructional phases of some recent deltas, such as the Mississippi, sand bodies comprise only a minor part of the total sediment, but in the Catskill complex they are the dominant component. This is a function of the proximity of the deltaic plain to the source terrain, in contrast to some recent deltas, which

are adjacent to low-relief coastal plains. The term "tectonic delta complex" is proposed for a deltaic complex built into a marine basin contiguous to an active mountain front and dominated by orogenic sandstones.—*from* Authors' abstract

00290 **Friedman, S. A.** Stratigraphic analysis of key beds in cyclothems in the Staunton Formation (Middle Pennsylvanian) in the Clinton Area, west-central Indiana: Jour. Sed. Petrology, v. 37, no. 1, p. 175–183, illus., table, 1967.

Detailed study of highly variable cyclothems has resulted in workable correlations of six unnamed coal beds beneath the Seeleyville Coal Member that marks the top of the Staunton Formation.—H.A.T.

Frischknecht, F. C. *See* Kane, M. F. 10108

10107 **Frischknecht, Frank C.** Application of electromagnetic surveying to geologic mapping in northern Maine. *in* Mining geophysics—V. 1, Case histories: Tulsa, Okla., Soc. Explor. Geophysicists, p. 10–17, illus., 1966.

In northern Maine black slate zones have been traced over distances of several miles by slingram surveys, although the thickness and conductivity usually vary considerably along strike. Most of the black slate zones are highly anisotropic and can be distinguished readily from massive conductors. Examples of electromagnetic surveys from two areas in northern Maine are given. In the Shin Pond quadrangle, black cherts of Ordovician age and black slate of Silurian age were traced. The anomalies are large and well defined, and the conductors appear to be fairly massive and uniform. The results from the Howe Brook quadrangle are less clear cut; however, an anisotropic black chert zone was traced over a distance of a few miles.—*from* Author's abstract

00258 **Frost, Stanley Harold.** Mexican Tertiary biostratigraphy and paleontology—Larger foraminifera and corals [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2410B–2411B, 1967.

10023 **Funkhouser, John Gray.** The determination of a series of ages of a Hawaiian volcano by the potassium–argon method [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1981B, 1966.

00162 **Gagliano, S. M.; Thom, B. J.** Deweyville terrace, Gulf and Atlantic Coasts [abs.]: Assoc. Am. Geographers Annals, v. 57, no. 1, p. 174–175, 1967.

Galay, Victor J. *See* Chitale, Shrikrishna V. 00303

Gamble, E. E. *See* Daniels, R. B. 10168

10015 **Gamble, Erling Edward.** Origin and morphogenetic relations of sandy surficial horizons of upper Coastal Plain soils of North Carolina [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1671B, 1966.

Garrels, Robert M. *See* Mackenzie, Fred T. 10285

10159 **Gaudette, H. E.; Grim, R. E.; Metzer, C. F.** Illite—A model based on the sorption behavior of cesium: Am. Mineralogist, v. 51, nos. 11–12, p. 1649–1656, illus., table, 1966.

Cesium-sorption studies of five natural illites and illitic mixed layer clays suggest that cesium fixation is caused by surface or edge sorption. One-dimensional structural analysis of the X-ray data gave no indication of interlayer exchanges. A "core-rind" model is proposed to explain the observations; the model proposes a structurally coherent silicate core for the clay platelet surrounded by a less coherent rind that is of variable width to account for the sorption properties.—E.Z.

00280 **Gay, S. Parker, Jr.** Geophysical exploration shows marked increase, *in* The search for ore: Mining Eng., v. 19, no. 2, p. 69–71, 73–74, 1967.

The tremendous upsurge in geophysical activity that began in 1964 shows no signs of levelling off. Brief accounts are given of exploration activities throughout the world. Magnetic, electromagnetic, and induced polarization methods continue to be the most popular. The problem of limited depth penetration, inherent in most electrical methods, is under attack with magnetotellurics in several places.—F.C.C.

Geis, Darlene. *See* Barr, Donald. 10132

10024 **Germundson, Robert Kenneth.** Stratigraphy and micropaleontology of some Late Cretaceous–Paleocene continental formations, Western Interior, North America [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1981B, 1966.

Gilbert, M. C. *See* Colville, Patricia A. 10145

10072 **Gill, J. E.** Principles and limitations of Precambrian stratigraphy [with French abs.], *in* Precambrian symposium—The relationship of mineralization to Precambrian stratigraphy in certain mining areas of Ontario and Quebec: Geol. Assoc. Canada Spec. Paper 3, p. 9–19, 1966.

Stratigraphic principles developed from studies of younger rocks apply equally well to Precambrian assemblages. Limitations due to lack of fossils and blurring or destruction of the record by metamorphism and intrusions are problems not found in the Phanerozoic. Most geologic work has been done where well preserved volcanics and sediments exist. What little work has been done on the other three-quarters, gneiss and igneous masses, indicates that little, if any, is original crust; much has been derived from sediments. Structural and isotopic dating show that continental platforms are made up of deformed belts of different ages, the less metamorphosed parts resembling younger orogenic belts, and the more metamorphosed interpreted as deeper parts exposed by long erosion. More detailed mapping is needed in these areas.—E.S.L.

00180 **Gillespie, William H.; Clendening, John A.** West Virginia plant fossils—[Pt.] 1, *Dolerotheca* and *Daubreeia*: West Virginia Acad. Sci. Proc. 1966, v. 38, p. 159–168, illus., 1967.

This is the initial contribution of a proposed illustrated series in which the taxonomy and stratigraphic relationships of West Virginia plant fossils will be discussed. *Dolerotheca pennsylvanica* Dawson ex White and *Daubreeia pateraeformis* (Germar) Zeiller are recorded from Monongahela and Monongahela–Dunkard sediments (Upper Pennsylvanian), respectively.—Authors' abstract

00287 **Gilman, Richard A.; Metzger, William J.** Cone-in-cone concretions from western New York: Jour. Sed. Petrology, v. 37, no. 1, p. 87–95, illus., 1967.

The cone-in-cone concretions in the Northeast Shale Member of the Canadaway Formation of Upper Devonian age in western New York are thought to have originated from a syngenetic concretion of fibrous aragonite. The conical structures are believed to have formed during the transformation from aragonite to calcite while the surrounding clay materials were still plastic.—H.A.T.

09949 **Gilmour, Ernest H.; Dahl, Gardar G., Jr.** (compilers). Index map and bibliography of coal studies in Montana: Montana Bur. Mines and Geology Spec. Pub. 39, 1 sheet, 1966.

10104 **Giroux, P. R.; Stoimenoff, L. E.; Nowlin, J. O.; Skinner, E. L.** Water resources of Branch County, Michigan: Michigan Geol. Survey Water Inv. 6, 158 p., illus., tables, 1966.

Branch County has abundant water resources throughout most of its area. Almost all the water used is supplied by wells that obtain water from glacial drift deposits and locally from fractures and sandy beds in the Coldwater Shale. Properly developed large-diameter wells tapping thick beds of sand and gravel of glacial drift can yield up to several thousands of gpm locally. Problems of water supply to wells exist locally in some moraine and till areas or where glacial drift is thin and underlying bedrock yields only small quantities of water or none at all. Ground

water is generally hard to very hard and often contains excessive iron. Salty water is mainly a problem in areas where bedrock is the chief source.—*from* Authors' abstract

00292 **Gluskoter, Harold J.** Clay minerals in Illinois coals: Jour. Sed. Petrology, v. 37, no. 1, p. 205–214, illus., table, 1967.

Ashing at temperatures below 190°C caused by activated oxygen produced by a radio frequency discharge permits study of essentially unaltered clay minerals from coals. Kaolinite, illite, and a mixed-layer illite-montmorillonite are the predominant clay minerals found. Montmorillonite and chlorite are present only in trace amounts. The areal distribution of the clay minerals is thought to be related chiefly to source areas in the east and northeast.—H.A.T.

Goles, Gordon G. *See* Stueber, Alan M. 00221

10209 **Goodman, Richard E.** On the distribution of stresses around circular tunnels in non-homogeneous rocks [with French and German abs.], *in* Internat. Soc. Rock Mechanics Congress, 1st, Lisbon, 1966, Proc., V. 2: Lisbon, Portugal, Laboratório Nacional Engenharia Civil, p. 249–255, illus., 1966.

The effect of constructing tunnels in layered rocks as opposed to homogeneous rocks is discussed in this paper. The results represent solutions to plane strain boundary value problems using a finite element analysis. When a circular tunnel is excavated along a vertical contact between two rock types with different elastic moduli, the stresses are found to increase in the harder material while the softer rock is relatively destressed. Results show the changes in stress distributions as the tunnel is constructed at varying distances from the contact between rock types. The effect of differing orientations of bedding and assumptions of initial rock stress have also been explored. Conclusions from multi-layered cases are also presented.—*from* Author's abstract

10054 **Goodwin, A. M.** The relationship of mineralization to stratigraphy in the Michipicoten area, Ontario [with French abs.], *in* Precambrian symposium—The relationship of mineralization to Precambrian stratigraphy in certain mining areas of Ontario and Quebec: Geol. Assoc. Canada Spec. Paper 3, p. 57–73, illus., tables, 1966.

The Michipicoten area has produced 27 million tons of iron ore, 189,000 oz of gold, and 18,000 oz of silver since the start of mining operations in 1899. The iron ore is associated with extensive bands of iron-formation which directly overlie several large masses of acidic pyroclastic rocks. These formations probably originated by subaqueous chemical deposition during periods of exhalative activity accompanying and following eruption of the great tuff breccia masses. Most gold and base metal occurrences are associated with acidic porphyry stocks situated within or marginal to the tuff masses. Geologic relations indicate a common origin for the acidic extrusive masses, the acidic porphyry stocks, and the iron, gold, and base metal mineralization.—E.S.L.

Goodwin, A. M. *See* Baragar, W. R. A. 10163

10051 **Goodwin, Alan M.** (editor). Precambrian symposium—The relationship of mineralization to Precambrian stratigraphy in certain mining areas of Ontario and Quebec: Geol. Assoc. Canada Spec. Paper 3, 144 p., illus., tables, 1966.

Of the eight papers comprising the symposium, two are general, and the rest deal with specific mining districts; all are cited individually.—E.S.L.

00148 **Gough, D. I.** Magnetic anomalies and crustal structure in eastern Gulf of Mexico: Am. Assoc. Petroleum Geologists Bull., v. 51, no. 2, p. 200–211, illus., 1967.

The eastern Gulf is dominated by northeast structural trends in the basement. A belt of inferred volcanic rocks trends southwest across Florida to the Campeche Scarp and lies at an estimated depth of nearly 9 km. West of this belt the mapped area is devoid of large magnetic anomalies; this suggests oceanic-type crust under

thick sedimentary cover. North of the eastern part of the Campeche Bank a large negative magnetic anomaly striking east-southeast may indicate a synclinal downwarp in the crust. There is no magnetic expression of the steep escarpment that terminates the west Florida shelf.—W.L.A.

00247 **Graham, David Wilson.** Stratigraphic and environmental analysis of the Hoxbar Group—Stephens County, Oklahoma [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2411B, 1967.

10025 **Grant, Alan Robert.** Bedrock geology of the Dome Peak area, Chelan, Skagit and Snohomish Counties, Northern Cascades, Washington [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1981B–1982B, 1966.

00110 **Gratton, Patrick J. F.; Lemay, William J.** New Mexico search for San Andres Permian oil most active in State: Oil and Gas Jour., v. 65, no. 12, p. 207, 210–212, illus., 1967.

The search for oil in the Permian San Andres Limestone along the northern flank of the Tatum basin is New Mexico's most active play. Hydrocarbon entrapment is structurally, stratigraphically and hydrodynamically controlled. The gamma ray–density log describes anhydrite beds and carbonate zones. The anhydrite beds become enlarged and the carbonate beds reduced to the north. Porosity increases southward in the carbonate zones. An estimated 62,000,000 bbl of oil and 81 1/2 billion cubic feet of gas have been found to date in the San Andres trend.—K.A.D.

10093 **Gregory, A. F.** Remote airborne sensing, *in* Contributions to geological exploration in Canada: Canada Geol. Survey Paper 66-42, p. 26–28, 1966.

Remote sensing research in the Geological Survey of Canada is directed toward remote measurement of various physical properties of rocks and minerals and geological interpretation of these geophysical data; the field of interest includes infrared, ultraviolet, microwave, radar, multi-spectral photography, and gamma radiation. Conclusions from preliminary results of interpretation of aerial color photography are that it is superior to panchromatic where color is the major criterion for recognizing geologic features and that cost should reduce with use. From recent investigations it is concluded that radiation detection techniques will continue to dominate over geochemical or other direct exploration methods, particularly in pinpointing discrete, exposed concentrations of uranium, thorium, and potassium; spectrometric methods may be useful in identifying and assessing specific radioelement content of such deposits.—M.C.M.

10058 **Gregory, Jack Lee.** A Lower Oligocene delta in the subsurface of southeastern Texas, *in* Deltas in their geologic framework: Houston, Tex., Houston Geol. Soc., p. 213–227, illus., table, 1966.

A middle Vicksburg delta composed of interbedded sand, silt, and shale and delineated in the subsurface has an areal extent of about 1,100 sq mi, a maximum thickness of 300 feet, and is buried beneath 2,500 to more than 9,000 feet of younger deposits. Sand distribution suggests that sediment was brought into the Vicksburg basin from the north by two rivers, or by one that frequently changed course. Two major axes of thickening are apparent: the axis normal to the shoreline represents sand-filled valleys and seaward extension of the delta; the axis parallel to the shoreline represents longshore current deposition. Data suggest that longshore currents flowed westward and deposited considerably more sand on that side. Oil and gas production from middle Vicksburg sands is restricted to the delta's seaward extension; most favorable traps are positive structures that existed during Vicksburg deposition.—*from* Author's abstract

00248 **Gregson, Victor Gregory, Jr.** A model study of elastic waves in a layered sphere [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2411B, 1967.

10178 **Griggs, Roy L.; Wagner, Holly C.** Geology and ore deposits of the Steeple Rock mining district, Grant County, New Mexico: U.S. Geol. Survey Bull. 1222-E, p. E1–E29, illus., tables, geol. maps, 1966.

The Steeple Rock mining district has produced about 7 million dollars in metals since 1882. The district lies in an area of block-faulted Tertiary lavas that have been intruded by rhyolite dikes and plugs. The ore commonly occurs in veins that occupy northwest-trending premineralization faults or in brecciated rock at fault intersections. The precious metal as well as the base-metal sulfide ores occur in a gangue of quartz and altered breccia. The precious metals are gold and silver; the sulfide ore minerals are sphalerite, galena, and chalcopyrite.—R.L.G.

Grim, R. E. *See* Gaudette, H. E. 10159

10238 **Griswold, George B.** Introduction to rock mechanics, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 344–363, illus., 1966.

The engineering properties of rocks are listed, the compressive strength discussed, and the principal relationships among physical properties summarized. Important factors obtained from the rupture envelope defined by the triaxial shear test are critical stress conditions that induce immediate failure, type of failure to be expected, and angle of shear at failure. Factors in the geologic environment affecting rock properties are listed, with fractures being the most important. Techniques of mapping fractures and bedding planes are described. Plastic behavior of rocks, and in situ stresses are discussed. Types of failure are listed under the slope stability problem. Techniques for predicting failure of openings and rock slopes are given.—E.S.L.

10026 **Groff, Donald William.** Spectrochemical analysis of sandstones and its classification implications [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1982B, 1966.

Gruenhagen, Gary. *See* Huss, Glenn I. 09991

00179 **Gualtieri, J. L.** Geologic map of the Crab Orchard quadrangle, Lincoln County, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-571, scale 1:24,000, section, text, 1967.

Petroleum has been produced from the "Corniferous" limestone in southwestern Crab Orchard quadrangle, but no record of past production is available; its accumulation seems related to a small synclinal structure. Natural gas for domestic use is reported to have been produced in the southeastern area. Clay usable for brick and tile is available in the lower Nancy Member of the Borden Formation, Crab Orchard Formation, and parts of the Boyle Dolomite. Mineral water, high in Epsom salts, was formerly obtained by concentrating ground-water seepage in pits dug into the Crab Orchard. Barite occurs in the Brassfield Dolomite in the northern area. Very small replacement nodules of galena and sphalerite have been found locally in Ordovician rocks. Instability of the lower Nancy Member of the Borden Formation is a factor affecting construction projects.—M.C.M.

10280 **Guilday, John E.; McCrady, Allen D.** Armadillo remains from Tennessee and West Virginia caves: Natl. Speleol. Soc. Bull., v. 28, no. 4, p. 183–184, illus., 1966.

Pleistocene remains of armadillo (*Dasypus*) of probable Sangamon age have been found in Robinson Cave, Overton County, Tenn., and in Organ-Hendricks Cave, Greenbrier County, W. Va.—M.S.T.

10176 **Gupta, Indra N.; Kisslinger, Carl.** Radiation of body waves from near-surface explosive sources: Geophysics, v. 31, no. 6, p. 1057–1065, illus., 1966.

Amplitude distributions obtained from observations of the azimuthal distribution of motion from cratering shots near a vertical limestone face yielded data on radiation into a half space. These effects have been approximately reproduced in the laboratory by means of two-dimensional seismic models. Shots on the edge of a plexiglas sheet produce P- and S-radiation patterns expected from a normal downward impulse on the free surface. The radiation patterns from cratering shots may be qualitatively explained by the combined action on the free surface of a normal downward stress and a pair of horizontal stresses (dipole without moment)

at the source. The data are not sufficient for verifying theoretical S-wave distribution.—V.S.N.

10027 **Gupta, Sujoy.** Palynology of Grassy Creek and Saverton Shales of Missouri [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1982B, 1966.

10155 **Guy, Brian B.; Jeffrey, G. A.** The crystal structure of fluellite, $Al_2PO_4F_2(OH)\cdot 7H_2O$: Am. Mineralogist, v. 51, nos. 11–12, p. 1579–1592, illus., tables, 1966.

The crystal structure of the mineral fluellite has been determined with the use of three-dimensional X-ray photographic data. The presence of phosphorous in the structure was confirmed by electron microscope analysis. The space group is *Fddd* with unit cell dimensions $a=8.546$, $b=11.222$, and $c=21.158$A, and $Z=8$. The structure is that of infinite chains of corner-sharing $[AlF_2\cdot O_4\cdot H_{3.5}]$ octahedra linked through $[PO_4]$ tetrahedra, forming channels which contain water molecules. The water molecules and hydroxl ions are hydrogen bonded in a way which permits proton configurational alternatives. Two of the oxygen atoms in the aluminum octahedra are shared with the $[PO_4]$ tetrahedra and the other two are statistically one quarter that of a hydroxyl ion and three quarters that of a water molecule.—*from* Authors' abstract

10000 **Guzman-Aguirre, A.** Estructura periclinal, en la porción norte, de la Sierra Madre Oriental [also English and French texts]: Photo Interprétation 66-3, p. 1–7, illus., 1966.

The periclinal structure north-northeast of Saltillo, Coahuila, Mexico, consists of an almost elliptical synclinal dome of Upper Cretaceous sedimentary rocks, and an adjoining anticline with buried center; fractures and faults extend to the north and south. Erosional terraces indicate that uplifting took place, and some parts of the structure that were buried by material from the initial erosion are again laid bare. Denudation is due to drainage controlled by the annular structure and fractures and faults. An airphoto of the whole structure and two half photos to use stereoscopically, and an interpretive overlay are included.—E.S.L.

10338 **Hafner, Stefan; Kalvius, Michael.** The Mössbauer resonance of Fe^{57} in troilite (FeS) and pyrrhotite ($Fe_{0.88}S$) [with German abs.]: Zeitschr. Kristallographie, v. 123, no. 6, p. 443–458, illus., tables, 1966.

The Mössbauer spectra were investigated between 4.2°K and 300°K. The spectrum of troilite consists of a sharp six line pattern which shows that all Fe atoms are magnetically equivalent. Shift of the magnetic hyperfine lines due to electric quadrupole interaction at the Fe site reveals that no principal axis of the electric field gradient tensor is parallel to the local magnetic field, which shows local symmetry at the Fe positions to be lower than orthorhombic. The spectra of pyrrhotite are complex but do not change over the temperature region investigated. They consist of a superposition of three six line patterns of nearly equal intensities. Thus at least three magnetically inequivalent Fe positions are present. This supports Bertaut's result that pyrrhotite may possess a structure with ordered vacancies among the Fe sites. No spectral evidence was found for structural trivalent Fe.—*from* Authors' abstract

00164 **Hagner, Arthur F.** Resume of the geology of the Laramie anorthosite mass—Discussion [of paper by M. A. Klugman, 1966]: Mtn. Geologist, v. 4, no. 1, p. 35–36, 1967.

Klugman (ibid., v. 3, no. 2, p. 75–84, 1966) stated that work done by Newhouse and Hagner (1945, 1949, 1950, 1957), with DeVore (1959), and DeVore (1948, 1955) indicated the Laramie anorthosite was a metasomatic rock. Hagner replies that these authors have not advocated any theory of origin for this mass, and that Klugman's remark on incomplete evidence is unjustified. Geologic maps must contain an appreciable amount of interpretation and the 1957 map by Newhouse and Hagner cannot be construed as favoring any single theory of origin of the Laramie Range anorthosite body.—M.C.M.

Haigler, Leon B. *See* Stipp, Thomas F. 00184

Hails, John R. *See* Hoyt, John H. 00112

10028 **Hait, Mortimer Hall, Jr.** Structure of the Gilmore area, Lemhi Range, Idaho [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1982B–1983B, 1966.

10181 **Halberg, H. N.; Stephens, J. W.** Use of water in Arkansas, 1965: Arkansas Geol. Comm. Water Resources Summ. 5, 12 p., illus., tables, 1966.

In 1965 Arkansas used an average of 2,142 mgd of ground and surface water—35 percent more than in 1960—for purposes other than production of hydroelectric power. More than half the total was used for irrigation, 80 percent of which was ground water. More than 97 percent of ground water was withdrawn in the Coastal Plain, practically all from Quaternary alluvium and Tertiary Sparta Sand; less than 1 mgd was returned to recharge ground-water reservoirs. More than half the water used was withdrawn from the ground. Surface-water supplies are commonly used in the northwestern half of the State, ground-water in the southeastern.—M.C.M.

00309 **Hall, Richard P.; Corbett, Robert G.** Distribution of sediments at Lake Lynn, West Virginia [abs.]: West Virginia Acad. Sci. Proc. 1966, v. 38, p. 158, 1967.

10180 **Halliday, William R.** Terrestrial pseudokarst and the lunar topography: Natl. Speleol. Soc. Bull., v. 28, no. 4, p. 167–170, illus., 1966.

Pahoehoe lava appears to be widespread on the Moon, though its parameters and those of any lava tube caverns contained therein probably differ significantly from those of Earth. To date, collapse features characteristic of lava tube areas have not been identified, but the potential importance of lunar lava tubes warrants considerable study. Terrestrial fissure caves in volcanic rocks may be correlable with lunar rills or postulated subsurface lunar "crevasses."—*from* Author's abstract

10110 **Hallof, Philip G.** A comparison of variable frequency IP results with Turam electromagnetic conductors, *in* Mining geophysics—V. 1, Case histories: Tulsa, Okla., Soc. Explor. Geophysicists, p. 172–178, illus., 1966.

An electromagnetic survey on a claim group in the Temagami area of Ontario resulted in several very strong conducting zones being outlined. Several drill holes under the best conductor did not locate the source of the anomaly. An induced-polarization survey on the property indicated that most of the EM conductors had no associated metallic mineralization. However, there was one definite IP anomaly that was associated with a weak EM conductor. When drilled, this zone was shown to be due to nickel-bearing sulfide mineralization.—Author's abstract

10134 **Hamilton, E. L.; vonHuene, R. E.** Kodiak Seamount not flat-topped: Science, v. 154, no. 3754, p. 1323–1325, illus., 1966.

A two-part survey in 1965 showed that Kodiak Seamount is not flat-topped, and should be eliminated from the category of guyots. Reflection profiles indicate that the seamount was formed before the adjacent sediments were deposited, and that the small trough on the south side is a depositional feature probably formed by a scouring effect or by the acceleration of turbidity currents around the base of the mount.—D.B.V.

10029 **Hamilton, Thomas Dudley.** Geomorphology and glacial history of the Alatna Valley, northern Alaska [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1983B, 1966.

00186 **Hansen, Arnold J., Jr.** Availability of ground water in parts of the Olmsted and Bandana quadrangles, in Jackson Purchase region, Kentucky: U.S. Geol. Survey Hydrol. Inv. Atlas HA-176, scale 1:24,000, sections, text, 1967.

The mapped areas of Olmsted and Bandana quadrangles are in northern Ballard and northwestern McCracken Counties. Ground water for all uses is abundant, principally from Pliocene(?) and Pleistocene gravel and alluvium. Saturated

thickness of the gravel ranges from 2–93 feet, and wells should yield up to 1,000 gpm; thickness of alluvial gravel ranges from 5–56 feet, and except where thickness is less than 10 feet, yields from wells may be several hundred gpm. Quality of water is satisfactory for most uses; although that from alluvium is generally soft and slightly acidic. The map sheet includes generalized and columnar sections and a table of pH and iron content of water analyses.—M.C.M.

00187 **Hansen, Arnold J., Jr.** Availability of ground water in the Clinton quadrangle, Jackson Purchase region, Kentucky: U.S. Geol. Survey Hydrol. Inv. Atlas HA-175, scale 1:24,000, section, text, 1967.

Ground water for domestic and industrial use is abundant in the Clinton quadrangle, principally from Eocene sands. These aquifers may be from 600–850 feet thick, and yields from properly constructed wells could be more than 1,000 gpm. Porters Creek Clay, underlying Eocene strata, is not an aquifer but serves to retard ground-water movement between the Eocene beds and underlying Cretaceous sediments. Quality of water in the main zone of saturation is satisfactory for most uses; quality of perched water depends upon local factors. The map sheet includes generalized and columnar sections, and a table of pH and iron content of water.—M.C.M.

00228 **Harbison, R. N.** DeSoto Canyon reveals salt trends: Oil and Gas Jour., v. 65, no. 8, p. 124–128, illus., 1967.

Seismic reflection profiles during 1965, following reconnaissance profiles made in 1963, located several geologic features in DeSoto Canyon in the northeastern part of the Gulf of Mexico. Five salt domes, six possible domes, an erosional surface, local faulting, and five groups of strata were recognized. The profiles were made on board the U.S. Coast and Geodetic Survey *Hydrographer* using a 3,000 joule arcer and a 14-ft hydrophone-array with 10 variable inductance hydrophones. The depth of penetration was nearly 2,000 feet. The postulated ages for the groups of strata range from Late Cretaceous or early Tertiary to Pleistocene. The domes seem to align with onshore salt trends.—K.A.D.

Harris, D. C. *See* Nuffield, E. W. 10148

10152 **Harris, D. C.; Brooker, E. J.** X-ray spectrographic analysis of minute mineral samples: Canadian Mineralogist, v. 8, pt. 4, p. 471–480, illus., tables, 1966.

X-ray spectral intensity ratios can be used directly to determine the atomic ratios in powdered mineral samples as small as 1 mg. Standardization and working curves for the determination of Cu/Fe, Pb/Sb, and Ag/Sb are given. Larger samples may lead to apparently erratic ratios because of the enhanced absorption effect owing to greater sample depth.—E.Z.

10189 **Harris, William H.; Wilder, Hugh B.** Geology and ground-water resources of the Hertford-Elizabeth City area, North Carolina: North Carolina Dept. Water Resources Ground-Water Bull. 10, 89 p., illus., tables, 1966.

The Hertford-Elizabeth City area is underlain by clay, silt, sand, shell, marl, and limestone sedimentary strata of Cretaceous and Tertiary age. The vertical succession and lateral migration of lithofacies units and aquifers across geologic time lines indicate the sediments were deposited during successive phases of marine transgression and regression. Although ten aquifers are recognized in the area, only three—Yorktown lower, Yorktown upper, and post-Miocene—furnish water of generally acceptable chemical quality. The water-table aquifer yields the least mineralized ground water, the Yorktown upper contains the only large amounts of useful artesian waters, and the Yorktown lower yields potable water from areas in which the artesian aquifer is greater than five feet above mean sea level. Saline water is present in the underlying Paleocene and Cretaceous aquifers.—*from* Authors' abstract

09983 **Harriss, Robert C.; Pilkey, Orrin H.** Interstitial waters of some deep marine carbonate sediments: Deep-Sea Research, v. 13, no. 5, p. 967–969, tables, 1966.

Interstitial waters of marine carbonate sediments from two cores collected on the Bermuda Apron were analyzed for dissolved chloride, sodium, calcium, magnesium, and silica. Only silica showed considerable deviation from that of average sea water. Metastable carbonate minerals (aragonite and high Mg calcite) were not present and Mg/Cl and Ca/Mg ratios of interstitial waters indicate that these minerals have not been dissolved or recrystallized in the deep sea sedimentary environment. Aragonite and high Mg calcite are present in carbonate sediments on the Bermuda Pedestal which serve as partial source materials for the deep sea carbonates. A considerable amount of selective dissolution and recrystallization of metastable carbonate minerals may occur during transport from shallow to deep sea sites of deposition.—*from* Authors' abstract

00131 **Hart, S. R.; Steinhart, J. S.; Smith, T. J.** Local and regional heat-flow variations: Carnegie Inst. Washington Yearbook 65, 1965–66, p. 66–67, 1967.

In view of the very thick, unusual and varied structure of the crust underlying Lake Superior, a program of heat-flow measurements was instituted in 1966, covering the western half of the lake. Results are expected to be reported in Yearbook 66. A program previously started on Seneca Lake, New York, for further study of reliability of deep-lake technique of measuring heat flow was continued.—V.S.N.

00158 **Hart, S. R.; Krogh, T. E.; Davis, G. L.; Aldrich, L. T.; Munizaga, F.** Rb/Sr geochronology in the Grenville province of Ontario: Carnegie Inst. Washington Yearbook 65, 1965–66, p. 59–63, illus., 1967.

Rb/Sr age data on granitic rocks of northwestern Grenville province, Ontario, establish that plutonic rocks occur with primary ages of about 1300, 1500, 1700, 2350 m.y., there are crystalline equivalents of rocks probably coeval with Huronian sediments in part of the area, younger intrusives (1,500±200 m.y.) are similar in age to those in the mid-continent region and possibly Nain province of Labrador, and the bimodal age pattern predicted for intrusive rocks studied was not found. The Grenville front is a boundary between regions with a different time of last metamorphism but not necessarily rocks of different primary ages.—V.S.N.

10063 **Hattin, Donald E.** Paleozoic rocks in Indiana, *in* Stratigraphic cross section of Paleozoic rocks—Colorado to New York: Am. Assoc. Petroleum Geologists Cross Sec. Pub. 4, p. 32–40, illus., 1966.

Cross section E–F includes two major complementary structures: the east flank of the Illinois basin and the Cincinnati arch; it is based on ten well logs, three of which penetrated the basement, and six the Cambrian. Periodic emergence of the platform is reflected in several regional disconformities. Subsidence in the Illinois basin influenced deposition during and after the Devonian. No Permian beds are present.—E.S.L.

10114 **Healey, D. L.** Gravity and seismic study of Yucca Flat, Nevada Test Site, Nye County, Nevada, *in* Mining geophysics—V. 1, Case histories: Tulsa, Okla., Soc. Explor. Geophysicists, p. 84–93, illus., tables, 1966.

Gravity studies conducted in Yucca Flat between 1959 and 1962 have defined the configuration of the pre-Cenozoic surface underlying Yucca Flat, the thickness of the Cenozoic tuffs and alluvium filling the Flat, and the major structural features in the pre-Cenozoic rocks that are probably fault zones. The alluvium and tuff of Yucca Flat have been used extensively for underground nuclear testing since the fall of 1961, and the resulting definition of the volume of these media has been a valuable contribution to efficient planning of these tests. Gravity results confirmed by seismic surveys and drill-hole information indicate that a contour map representing the configuration of the pre-Cenozoic surface is accurate to within±20 percent.—Author's abstract

10013 **Heaslip, William Graham.** Cenozoic evolution of the alticostate venericards in Gulf and east coastal North America [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1983B–1984B, 1966.

09958 **Hedge, Carl E.** Variations in radiogenic strontium found in volcanic rocks: Jour. Geophys. Research, v. 71, no. 24, p. 6119–6120, illus., tables, 1966.

Analysis of the Sr isotopic composition of volcanic rocks reveal variations of nearly 2 percent in the amounts of radiogenic Sr–87 that is found in these rocks at their times of eruption. Oceanic basalts exhibit a small but real range in radiogenic Sr which probably reflects regional inhomogeneities in the upper mantle. Many continental basalts are isotopically similar to oceanic basalts; however, most continental felsic volcanics are significantly enriched in radiogenic Sr. The data suggest that continental felsic volcanic rocks have been derived within the crust or have been appreciably contaminated by crustal material.—Author's abstract

00307 **Heinis, Julius L.** A fossil plant locality in McDowell County, West Virginia [abs.]: West Virginia Acad. Sci. Proc. 1966, v. 38, p. 83, 1967.

10111 **Heinrichs, Walter E., Jr.** Geophysical investigations, Ore Knob mine, Ashe County, North Carolina, *in* Mining geophysics—V. 1, Case histories: Tulsa, Okla., Soc. Explor. Geophysicists, p. 179–184, illus., 1966.

Induced-polarization (IP) electrical surveys will give excellent and conclusive response over relatively smaller massive mineral occurrences similar to the Ore Knob deposit. Reconnaissance application of the method for such size targets is still somewhat limited by cost, but when applied with geology, geochemistry, and other methods such as self-potential, magnetics, and perhaps Afmag, then IP can and should be used at least as a tool for more detail. Results did not locate any immediate extensions to the known Ore Knob deposit, but did emphasize the essential part that geophysics can play in the future discovery and development of mineral deposits in the region. Some knowledge of the manner in which geophysical methods may be applied, in this environment, was acquired.—Author's abstract

00168 **Hendry, Charles W., Jr.; Yon, J. William, Jr.** Stratigraphy of the upper Miocene Miccosukee Formation, Leon and Jefferson Counties, Florida: Am. Assoc. Petroleum Geologists Bull., v. 51, no. 2, p. 250–256, illus., 1967.

The Miccosukee Formation is erected for deltaic, surficial deposits characteristically exposed in Jefferson and Leon Counties, Fla. The age of these sediments is post-middle Miocene to pre-Pleistocene. They are considered to be predominantly late Miocene in age. Underlying the Miccosukee unit is a marine clastic sequence, the middle Miocene Hawthorn Formation, with which it has been previously combined.—C.W.H.

09978 **Herdendorf, Charles E.** Geology of the Vermilion West and Berlin Heights quadrangles, Erie and Huron Counties, Ohio [map]: Ohio Div. Geol. Survey Rept. Inv. 60, scale 1:24,000, section, text, 1966.

Nearly all unconsolidated material overlying bedrock of the Vermilion West and Berlin Heights quadrangles is glacial in origin, deposited either directly by the Wisconsin ice sheet or in glacial lakes that were predecessors of Lake Erie. Widely scattered lagoonal deposits are present in the beach ridges. Mineral resources of the area are: Berea Sandstone, Red Bedford Shale used for brick and tile, minor oil and gas for domestic purposes, sand and gravel, glacial till, and ground water. The best aquifer is the Berea Sandstone with yield to wells ranging from 15–60 gpm.—M.C.M.

10084 **Hershey, Robert E.** Mineral resources summary of the Sardis quadrangle, Tennessee: Nashville, Tenn., Tennessee Div. Geology, 3 p., 1966.

This accompanying text for Tennessee Div. Geology Geol. Map GM 12-NE by E. E. Russell, 1966 (cited separately), describes the gravel resources in the Sardis quadrangle. There are three inactive pits in the area, but there are abundant reserves in the vicinity of the pits. These erosional remnants of alluvium are as much as 40 feet thick on some of the southern hills. Potential resources are sand and clay.—M.C.M.

10099 **Heusser, Calvin J.** Pleistocene climatic variations in the western United States, *in* Pleistocene and post-Pleistocene climatic variations in the Pacific area, a symposium—Pacific Sci. Cong., 10th, Honolulu, 1961: Honolulu, Hawaii, Bishop Mus. Press, p. 9–36, illus., tables, 1966.

Fossil remains from California point to a Pleistocene mean annual temperature 2° to 4.4°C lower than now. Coastal precipitation was 10 to 38 cm heavier. Several temperature shifts are indicated. Episodes of pre-Wisconsin glaciation range from four in Alaska to none in southern California; Wisconsin glaciation usually consists of two. Two pluvials are indicated in the arid regions: C-14 chronology dates one at 40,000 B.P., and the other beginning at 28,000 B.P. Mean annual temperature in New Mexico is calculated to have been about 2–5°C lower than today. The few late-glacial fossil records in the cordillera show three phases corresponding to those in the Midwest. Postglacial pollen profiles, especially in the Northwest, represent three major intervals—cool and moist, maximum warmth and dryness, and cooler and wetter. Glaciers and pluvial lakes fluctuated as the climate changed.—E.S.L.

10030 **Heylmun, Edgar Baldwin.** Systematic rock joints in parts of Utah, Colorado, and Wyoming, and a hypothesis on their origin [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1984B–1985B, 1966.

10298 **Heywood, W. W.** Ledge Lake area, west of principal meridian, Manitoba and Saskatchewan: Canada Geol. Survey Map 1167A (also in Mem. 337), scale 1:12,000, 1965 [1966].

10313 **Heywood, W. W.** Ledge Lake area, Manitoba and Saskatchewan [with French, German, and Russian abs.]: Canada Geol. Survey Mem. 337, 43 p., illus., tables, geol. map, 1966.

The Precambrian volcanic Amisk Group, with an exposed thickness of 17,000 feet, is unconformably overlain by the sedimentary Missi Group (Precambrian) in adjacent areas and in fault contact with it in this area. Rocks ranging in composition from diorite to granodiorite have intruded the Amisk volcanic rocks and related diabase dikes and sills. Intense folding of the Amisk rocks was accompanied by intrusion of the Kaminis granodiorite. Low-grade regional metamorphism has resulted in the development of greenschist, greenstone, and meta-diabase characterized by a low-grade metamorphic mineral assemblage. A thermal metamorphic aureole, averaging about 3,500 feet wide, around the Kaminis granodiorite contains mineral assemblages representing a medium-grade zone and, near the contact, a high-grade zone.—*from* Author's abstract

00217 **Hietanen, Anna.** Scapolite in the Belt Series in the St. Joe-Clearwater region, Idaho: Geol. Soc. America Spec. Paper 86, 56 p., illus., tables, geol. map, 1967.

Scapolite, a common rock-forming mineral in parts of the Belt Series in southern Shoshone County and nearby parts of Clearwater County, Idaho, is most abundant in moderately metamorphosed calcareous shaly layers of the Wallace Formation but occurs also in their highly metamorphosed equivalents and in the lowest part of the Prichard Formation. The mode of occurrence varies with distance from the Idaho batholith, with bulk composition, and with grade of metamorphism. The mode of occurrence and the distribution parallel to bedding suggest that scapolite crystallized from a sedimentary rock that contained saline minerals. Scapolite contains much Cl but only a little SO_3, suggesting that halite was the chief source mineral.—*from* Author's abstract

Hills, L. V. *See* Trettin, H. P. 10316

Hitchon, Brian. *See* Hodgson, G. W. 10087

00249 **Hodges, Carroll Ann.** Geomorphic history of Clear Lake, California [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2411B–2412B, 1967.

10087 **Hodgson, G. W.; Hitchon, Brian.** Research trends in petroleum genesis, *in* Commonwealth Mining and Metall. Cong., 8th, Australia and New Zealand, 1965,

Proc.—Petroleum, Pubs., V. 5: Melbourne, Australia, Australasian Inst. Mining and Metallurgy, p. 9–19, illus., 1966.

Interest has changed from studies concerning the source of hydrocarbons to those concerning their mobilization. This mobilization and migration can be considered in terms of water and hydrocarbon cycles. There is a delicate balance between hydrocarbons carried in moving water systems and those in stationary phases. For petroleum to accumulate requires coincidence of the disaccomodation of hydrocarbons from the moving water system, and entry of the water into a quasi-stagnant area. Oil fields are geologically transient and research efforts also must be directed to a study of dissipation mechanisms.—E.S.L.

Hoffman, I. *See* Schnitzer, M. 00214

00197 **Hoffmeister, J. E.; Stockman, K. W.; Multer, H. G.** Miami Limestone of Florida and its Recent Bahamian counterpart: Geol. Soc. America Bull., v. 78, no. 2, p. 175–189, illus., 1967.

The Miami Oölite of Sanford (1909) is redesignated Miami Limestone; it consists of an upper unit called the oölitic facies and a lower unit called the bryozoan facies. The bryozoan facies forms the surface rock over nearly 2,000 sq mi in the southern Everglades. In southeastern Florida cross-stratified oölitic limestone forms an elongate mound that thins westward over the bryozoan facies. Similar conditions now exist on the western part of the Great Bahama Bank, where a large underwater mound of unstable oölite is forming while east of the mound, massive colonies of tubular bryozoans are growing. Tidal channels normal to the unstable mound cut the eastern slope and are similar to narrow valleys in the oölitic facies of the Miami Limestone.—J.G.V.

10141 **Holm, J. L.; Kleppa, O. J.** The thermodynamic properties of the aluminum silicates: Am. Mineralogist, v. 51, nos. 11–12, p. 1608–1622, illus., tables, 1966.

The heats of formation, from the oxides, of the three polymorphs of Al_2SiO_5 (kyanite, andalusite and sillimanite) and of mullite, $3Al_2O_3 \cdot 2SiO_2$, have been measured by oxide melt solution calorimetry at 968°K. On the basis of the results, and of entropy, heat content, and volume data taken from the literature, the P-T diagram for the Al_2O_3-SiO_2 system has been calculated for a wide range of temperatures and pressures. This diagram is in reasonable agreement with recent high temperature high pressure experimental work and with some data based on direct geological observations.—*from* Authors' abstract

10164 **Hood, Peter.** A renaissance in magnetic methods of prospecting, *in* Contributions to geological exploration in Canada: Canada Geol. Survey Paper 66-42, p. 15–21, tables, 1966.

Resurgence of interest in magnetic prospecting in Canada is due mainly to increased acceptance of geophysical methods, increased production of aeromagnetic maps, generally low cost of aeromagnetic surveys, new types of magnetometers (listed in a table), digital recording of aeromagnetic survey data, and successful completion of an airborne telemetering magnetometer system (Telmag). Electronic magnetometers have now replaced to a large extent the magnetic-balance type of instrument; speculations are made on their possible future use. A neglected factor in magnetic interpretation has been the effect of remanent magnetism in producing anomalies found on magnetic contour maps; the Geological Survey of Canada has a continuing program to investigate magnetic properties of rocks, and instrumentation has been and is being developed for laboratory and field use. Some examples of field investigations in recent years are described.—M.C.M.

10243 **Hood, Russell G.** Role of the engineering geologist in public works, *in* Seminar on "The importance of the earth sciences to the public works and building official," Anaheim, Calif., 1966: Glendale, Calif., Assoc. Eng. Geologists, Los Angeles Sec., p. 20–32, 1966.

As an illustration of growth in the field of engineering geology, the California Department of Water Resources employed one engineering geologist between 1934

and 1941, and from then stepped up the number to over 110 today. The scope of the engineering geologist includes investigation of foundations for all types of structure; natural conditions along tunnels, pipe lines, canals, and highways; sources of rocks, sediments, and soils for construction materials; development of ground water resources; and control of landslides, flood, and earthquake hazards. His report should include a superimposed geologic map, substructure cross-sections, and detailed log of borings and test pits. Need for his services should be considered on every public works project where properties of the earth have a bearing on safety and successful operation.—G.D.C.

10137 **Hopkins, H. T.** Fresh-saline water interface map of Kentucky: Lexington, Ky., Kentucky Geol. Survey, scale 1:500,000, section, text, 1966.

Present water development in Kentucky has been limited largely to shallow fresh ground water and to water from streams; the deeper fresh and slightly saline water at depths ranging from 100–2,000 feet below the surface has remained virtually undeveloped. The map affords a means of determining water availability throughout the State, but specifically, the minimum depth of saline water at a particular point or for a more general area. The text presents general geology, geohydrologic controls and their relation to the interface, and general chemical characteristics of the water above and below the interface for each of the physiographic regions—Jackson Purchase, Mississippian Plateau, Western Coal Field, Blue Grass, and Eastern Coal Field.—M.C.M.

Hopkins, William E. *See* Matten, Lawrence C. 00177

00259 **Hoque, Mominul.** Stratigraphy, petrology, and paleogeography of the Mauch Chunk Formation in south-central and western Pennsylvania [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2412B, 1967.

10057 **Horowitz, Daniel H.** Evidence for deltaic origin of an Upper Ordovician sequence in the central Appalachians, *in* Deltas in their geologic framework: Houston, Tex., Houston Geol. Soc., p. 159–169, illus., tables, 1966.

Three successive stratigraphic units in the Upper Ordovician in Pennsylvania represent the subaqueous portion of a deltaic sequence deposited by a band of coalescing small deltas which prograded westward during the Taconic uplift. The basal unit consists of graded sandstone interpreted as turbidites in bottom-set beds, and fossiliferous shale. The medial unit exhibits slump features and consists chiefly of unlaminated, fossiliferous, poorly sorted, clayey sandstone and siltstone, interpreted as a deltaic fore-set slump deposit, the source material for turbidity currents. The upper unit consists of sparingly fossiliferous silty shale interbedded with laminated sandstone and other rocks which are inferred to be the top-set portion of the subaqueous sequence. Unfossiliferous cross-bedded sandstone and coal(?)-bearing shale overlying the upper unit probably represent the subaerial top-set beds.—*from* Author's abstract

10319 **Howard, Hildegarde.** Additional avian records from the Miocene of Sharktooth Hill, California: Los Angeles County Mus. Contr. Sci., no. 114, 11 p., illus., tables, 1966.

Nineteen avian bones collected in the early 1960's represent seven extinct species, one of which, a small albatross, is described as new. Several specimens contribute significant information concerning undescribed portions of the skeleton of species previously recorded. The avifauna as a whole is specifically distinct from those of other California marine Miocene localities.—Author's abstract

10031 **Howard, James D.** Upper Cretaceous Panther Sandstone Tongue of east-central Utah, its sedimentary facies and depositional environments [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1985B, 1966.

10032 **Howe, Robert Crombie.** Paleontology of the Mississippian, Sunwapta Pass, Alberta [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1985B–1986B, 1966.

00169 **Howells, William.** Mankind in the making—The story of human evolution (revised edition): Garden City, N. Y., Doubleday and Co., 384 p., illus., 1967; originally published 1959.

Chapter headings in this revised edition are: evolution; vertebrates; mammals; the primates; man and the anthropoids; primates in the past; Dart, Broom, Leakey, and *Australopithecus*; evolution in the primates; the Pleistocene—age of man; Java Man; Peking Man; Europe, Africa, and the rise of *Homo*; the Neanderthals; *Homo sapiens* arrives; unfinished business; the search for *Homo sapiens*; Piltdown Man—his rise and fall; races of man; the Europeans; Asians and Americans; dark continent, dark past; the eastern tropics; looking backward; and how to be human. Appended are author's notes, tables of primates among the vertebrates and man among the primates, a glossary, and an index.—M.C.M.

Howie, R. A. *See* Deer, W. A. 10138

00112 **Hoyt, John H.; Hails, John R.** Pleistocene shoreline sediments in coastal Georgia—Deposition and modification: Science, v. 155, no. 3769, p. 1541–1543, illus., 1967.

New evidence invalidates the former concept that Pleistocene shorelines are "terrace" cut and fill structures. Comparison of Pleistocene and Holocene sediments with morphology of the shoreline indicates that Pleistocene deposits accumulated in barrier-island environments and that the terraces are former lagoon-salt marshes. Stratigraphic evidence supports six major Pleistocene shorelines below an elevation of 100 feet (30 meters).—Authors' abstract

00227 **Hsu, Pa Ho.** Effect of salts on the formation of bayerite versus pseudo-boehmite: Soil Sci., v. 103, no. 2, p. 101–110, illus., table, 1967.

Alumina precipitates were prepared by adding NaOH to $AlCl_3$ in the presence of various strong electrolytes: NaCl, NaBr, NaI, $NaNO_3$, $NaClO_4$, KCl, or CsCe. The precipitate was found to be bayerite, pseudo-boehmite, or a mixture of both depending on the salt concentration, components of the salt, and $NaOH/AlCl_3$ ratio. In general, bayerite was obtained at low salt concentrations and pseudo-boehmite was obtained at high salt concentrations.—J.W.H.

Huang, W. W. H. *See* Johns, W. D. 00229

10333 **Hudson, J. A.; Knopoff, Leon.** Signal generated seismic noise: Royal Astron. Soc. Geophys. Jour., v. 11, nos. 1–2, p. 19–24, 1966.

A certain amount of incoherent wave motion due to the scattering effect of small variations in the elastic properties of the Earth is recorded as "noise" along with the main seismic signal. When the problem is treated statistically, mean square amplitudes of the scattered waves and fluctuations in amplitude and phase of the incident signal can be calculated for wave motion which is simple-harmonic in time. Results have already been reported for an incident plane wave in an infinite medium (1964). Extension to higher frequencies shows that the Rayleigh fourth-power law holds only for wavelengths greater than the linear extent of the scattering centers. If the inhomogeneities lie near a plane free surface, Rayleigh waves are generated. Amplitudes have been calculated for incident plane P- and S-waves.—D.B.V.

Huebschman, Eugene C. *See* Martinek, Johann. 10331

Hunt, Gail S. *See* West, Phillip J. 10241

Huss, Glenn I. *See* Nininger, H. H. 09988

09989 **Huss, Glenn I.; Moore, Carleton B.; Busek, Peter R.** The Fremont Butte, Washington Co., Colorado, meteorite: Meteoritics, v. 3, no. 2, p. 73–78, illus., 1966.

The meteorite was found near Fremont Butte, Colo., in 1963. A single individual was found weighing 6.6 kg. It is an olivine-hypersthene or L group chondrite

showing brecciation and a small number of well formed chondrules and olivine phenocrysts.—Authors' abstract

09991 **Huss, Glenn I.; Moore, Carleton B.; Gruenhagen, Gary.** The Anoka, Minnesota, iron meteorite: Meteoritics, v. 3, no. 2, p. 83–87, illus., 1966.

The Anoka, Minnesota, meteorite was found on the Joe Fields Farm at location coordinates 45°12′ N., 93°26′ W. It is a fine octahedrite distinguished by large fields of dense plessite. The chemical analysis of the meteorite is 84.9 percent iron, 11.75 nickel and 0.51 cobalt.—Authors' abstract

10151 **Hutchison, W. W.** Two stages of decrepitation of micas: Canadian Mineralogist, v. 8, pt. 4, p. 437–460, illus., tables, 1966.

On being heated to 1,000°C, biotite, muscovite, lepidolite, zinnwaldite and some phlogopites decrepitate in two distinct stages. The lower temperature stage has a sharp peak rate in the range of 305°–340°C for all the micas examined, but it was never exhibited by chlorite. This stage may be related to the rapid loss of an extremely small amount of water from the mica. A more vigorous stage starts in the range 550°–750°C and rises to a peak in the range 600°–1,000°C. The temperature of the peak rate and the character of the decrepitation appear to be dependent, in part, on the nature of the mica. It appears that this stage is mainly caused by the partial loss of lattice water during heating.—E.Z.

00129 **Hutton, A. N.** A new technique for the study of smaller foraminifera in indurated limestone: Micropaleontology, v. 13, no. 1, p. 107–110, illus., table, 1967.

A simple method is described for obtaining orientated sections of smaller foraminifera from slices of indurated limestone using a surgical scalpel and small diamond drill bits.—Author's abstract

00210 **Imlay, Ralph W.** Twin Creek Limestone (Jurassic) in the western interior of the United States: U.S. Geol. Survey Prof. Paper 540, 105 p., illus., tables, 1967.

The Twin Creek Limestone crops out along the Wyoming-Idaho border and in north-central Utah, thickens westward from several hundred feet to nearly 3,000 feet, consists of seven members, and ranges in age from probable middle Bajocian to early Callovian. It was deposited at the northern end of a northward-trending trough whose axis lay west of the westernmost Jurassic now exposed. Ammonites of late Bajocian age occur in limestones directly overlying the basal member. Studies of the pelecypods and ammonites present furnish accurate correlations with Jurassic rocks in other parts of the western interior region. Three ammonite genera, *Eocephalites, Sohlites, and Parachondroceras*, are described as new.—R.W.I.

10275 **Internat. Conf. Soil Mechanics** (and Foundation Eng.). Proceedings of the 6th International Conference on Soil Mechanics and Foundation Engineering, Montreal, 1965, Proc., V. 3: Toronto, Ontario, Univ. Toronto Press, 611 p., illus., tables, 1966.

In addition to individually cited papers by J. M. Harrison, A. Mayer, J. H. Keyser, J. K. Sexton, and J. Feld, this volume contains several general reports (published in 1965) and panel discussions on: soil properties (general, shear strength and consolidation), shallow foundations and pavements, deep foundations, earth and rock pressures, and earth and rock dams, slopes, and open excavations.—M.C.M.

10226 **Ippen, Arthur T.** (editor). Estuary and coastline hydrodynamics: New York, McGraw-Hill Book Co. (Eng. Soc. Mons.), 744 p., illus., tables, 1966.

Following the organization of a course on this subject at Massachusetts Institute of Technology in 1960, the lecture notes of participating oceanographers and engineers were revised and amplified, leading to publication of this text for teaching as well as for self-study by scientists and engineers interested in problems of near-shore oceanography and coastal engineering. The presentation of various topics in self-contained chapters by individual authors leaves ample scope for courses with

varied emphasis. Three chapters (Johnson, Ippen, Simmons), dealing with sedimentation problems are cited separately.—G.D.C.

10330 **Ippen, Arthur T.** Sedimentation in estuaries, [Chap.] 15 *in* Estuary and coastline hydrodynamics: New York, McGraw-Hill Book Co. (Eng. Soc. Mons.), p. 648-672, illus., 1966.

Estuary sediments are transported as in normal streams, but due to time-dependent currents no equilibrium can exist. As a result of internal flow and diffusion phenomena, sediments settling to the bottom zone will generally be transported upstream, shoals will form near the ends of saline intrusion zones and where net bottom velocity is zero due to local disturbances such as by tributary channels; intensity of shoaling will be most extreme for stratified estuaries and more dispersed in the well mixed estuary. Colloidal components are most responsible for deformation of channels by flocculation. Any structural measure contributing to a shift of the regime toward stratification will increase shoaling. Sediments dredged from channels should be permanently removed from the estuary.—G.D.C.

00260 **Iranpanah, Assad.** Petrology, origin and trace element geochemistry of the Ada Formation, Seminole and Pontotoc Counties, Oklahoma [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2412B-2413B, 1967.

10001 **Isbister, John.** Geology and hydrology of northeastern Nassau County, Long Island, New York: U.S. Geol. Survey Water-Supply Paper 1825, 89 p., illus., tables, geol. map, 1966.

The ground-water reservoir of Nassau County on Long Island is a wedge-shaped body of Cretaceous-Quaternary coastal-plain deposits from 400 to 1,300 feet thick. It consists of a principal aquifer of all beds (mostly Magothy(?) Formation) between the water table and the top of the clay member of the Raritan Formation, and of a deep confined aquifer chiefly of the Lloyd Sand Member of the Raritan Formation but locally of the Jameco Gravel. The latter is the only water source for public and domestic supply along the north shore. Gross withdrawals were 43 million gallons per day in 1960, chiefly from the principal aquifer. Most pumped water was returned through recharge basins, diffusion wells, and cesspools. Chemical quality is good to excellent. Resources of northeastern Nassau County are not fully developed and withdrawals could be increased substantially.—V.S.N.

00294 **Izard, John E.; Clemency, Charles V.** X-ray study of the sedimentary pyrite of western New York: Jour. Sed. Petrology, v. 37, no. 1, p. 221-225, illus., table, 1967.

X-ray examination of a large number of iron disulfide samples collected from the sedimentary rocks of western New York showed the presence of only pyrite, although some of this material has long been referred to in the literature as marcasite.—*from* Author's abstract

10294 **Jackson, D. B.** Deep resistivity probes in the southwestern United States: Geophysics, v. 31, no. 6, p. 1123-1144, illus., table, 1966.

Eight deep resistivity probes (dipole method) were made along a traverse extending from southwestern Colorado to southern California. In the Colorado Plateaus province the electrical basement usually coincides with the top of Paleozoic carbonate rocks. Resistant basement rock was detected at only three of the five sounding locations in that province; there, minimum possible basement resistivity was 2,000 to 6,000 ohm-m. Electrical basement was detected in the Basin and Range province; minimum possible resistivity was 600 to 1,000 ohm-m. Near Barstow, Calif., the resistant portion of the crust may be 9-10 km thick, with a resistivity of 600-700 ohm-m; it is underlain by a conductive zone.—D.B.V.

Jackson, W. H. *See* Roller, J. C. 10136

10240 **Jahns, Richard H.** Geologic and seismic factors pertinent to the Bolsa Offshore (artificial island) site area, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 377-379, 1966.

The flat sea floor in the area of the Bolsa Offshore site is underlain by 40–50 feet of Recent moderately compact sand with local silt lenses; below this is the Pleistocene San Pedro Formation. The nuclear plant site area lies along or possibly athwart the northwesterly-trending Newport–Inglewood anticline with its associated complex active faulting. This faulting does not appear to affect the site area; however, earthquakes can be anticipated. Some subsidence due to compaction of foundation materials is expected to occur. It is concluded that the site is a feasible one for the island and plant facilities.—E.S.L.

10220 **Jambor, J. L.** Constituents of cacoclasite: Canadian Mineralogist, v. 8, pt. 4, p. 527–529, table, 1966.

Cacoclasite from Wakefield, Ottawa County, Quebec, was re-examined optically and by X-ray techniques and found to be a mixture of calcite, prehnite, and grossular with minor amounts of apatite and clinopyroxene; thus the name should be abandoned.—B.C.H.

James, D. E. *See* Steinhart, J. S. 00133

10201 **Jarosewich, Eugene.** Chemical analyses of ten stony meteorites: Geochim. et Cosmochim. Acta, v. 30, no. 12, p. 1261–1265, table, 1966.

A group of stony meteorites, mainly unequilibrated chondrites, has been analyzed chemically; results are presented here for 10: Bishunpur, Khohar, and Semarkona (India); Bonita Springs (Florida); Coolidge (Kansas); Clovis (New Mexico); Ehole (Angola); Hallingeberg (Sweden); Ioka (Utah); and Karatu (Tanganyika).—D.B.V.

Jeffrey, G. A. *See* Guy, Brian B. 10155

09946 **Jeletzky, J. A.** Upper Volgian (latest Jurassic) ammonites and buchias of Arctic Canada [with French abs.]: Canada Geol. Survey Bull. 128, 51 p., illus., 1966.

Ammonite and *Buchia* (pelecypod) faunas of latest Jurassic rocks from 18 localities in Arctic Canada are correlated with standard biostratigraphic zones of late Lower and Upper Volgian stages of the Central Russian basin. Five subspecies of *Craspedites (Taimyroceras?) canadensis*, n.sp., four species of *Dorsoplanites*, one species of *Laugeites?*, and four species, one new, of *Buchia* are described and figured, with discussion of stratigraphic position and age. The main faunal elements of the Canadian zones are: late Lower Volgian, *Buchia piochii* varieties; early Upper or latest Lower Volgian, *B. richardsonensis*, n.sp.; early Upper Volgian, *B. fischeriana*, s.l., and species of *Dorsoplanites*; late Upper Volgian, *Craspedites canadensis*, n.sp., and *B. unschensis*.—V.M.J.

10147 **Jenness, S. E.** (editor). Contributions to geological exploration in Canada (seven papers by officers of the Geological Survey of Canada): Canada Geol. Survey Paper 66-42, 28 p., illus., tables, 1966.

The seven papers in this report were prepared for the 1965 Annual Review Number of the Northern Miner. Collectively they provide a clear picture, in nontechnical language, of some recent investigations by the Geological Survey of Canada.—*from* Editor's introduction

00120 **Jindra, Roy.** Wilcox trend of South Texas may still have exploration future: Oil and Gas Jour., v. 65, no. 9, p. 189–190, 193–194, illus., 1967.

Exploration programs in most major South Texas oil-producing trends have been revised with emphasis on deeper drilling on flanks and in offshore areas. With some exceptions the Wilcox trend of South Texas has been neglected. The Eocene Wilcox Formation, which has been divided into lower, middle and upper parts, consists of rocks deposited in continental or shallow marine environments; much of it contains sandstone bodies deposited as offshore bars or fluvial deposits. Over 200 fields in the Wilcox trend produce mostly from the upper part; very few of the older fields have been explored at depth or in downdip areas. Future exploratory programs should include deeper wells in these areas. Sand development in the

middle and lower parts of the formation is controlled environmentally and could occur at any horizon.—K.A.D.

10002 **Joesting, H. R.; Case, J. E.; Plouff, Donald.** Regional geophysical investigations of the Moab–Needles area, Utah: U.S. Geol. Survey Prof. Paper 516-C, p. C1–C21, illus., table, geol. map, 1966.

Aeromagnetic and gravity surveys of 1,450 sq mi in the Moab–Needles area of Utah within the Paradox evaporite basin obtained information on depth, composition, and configuration of the Precambrian basement, and on major salt anticlines. Basement rock of the southern part shows greater magnetic diversity and thus more compositional diversity than the northern deeper part of the evaporite basin. The central part has three prominent magnetic highs associated with stocklike masses in the basement. Upheaval Dome, probably an intrusive salt plug, is near the crest of one high. Gravity lows occur over large salt anticlines of Moab and Salt Valleys; part of the Moab Valley anomaly is related to a basement fault. Gravity and magnetic gradients in the central part mark a major lithologic and structural change in the basement. A buried trough along the Colorado River also is indicated.—V.S.N.

00229 **Johns, W. D.; Huang, W. W. H.** Distribution of chlorine in terrestrial rocks: Geochim. et Cosmochim. Acta, v. 31, no. 1, p. 35–49, illus., tables, 1967.

Data on the relative abundance of chlorine in various terrestrial rocks are reviewed critically. The mean chlorine contents of igneous rocks (in ppm) are: ultramafic, 100; mafic, 160; intermediate, 180; acidic, 200; syenites, 430; nepheline syenites, 2,170. For sedimentary rocks the corresponding values are: shales and clays, 100; sandstones, 20; limestones, 130; dolomites, 660. For metamorphic rocks the values are: schists, 350; gneisses, 200; amphibolites, 300. Both the paragenesis and crystal chemistry of mineral constituents affect the mode of distribution. Chlorite abundances in the crust and upper mantle are estimated to be 180 and 100 ppm, respectively.—D.B.V.

00118 **Johnson, Frederick.** Radiocarbon dating and archeology in North America: Science, v. 155, no. 3759, p. 165–169, 1967.

The history of development of a radiocarbon chronology shows how the establishment of the times of events and their order has greatly improved the understanding of North American prehistory. Existing discordances between archeologically determined sequences and interregional associations on the one hand, and radiocarbon chronology on the other, will probably be resolved as dates are added and as the results become more finely calibrated to allow for secular variations.—D.B.V.

10315 **Johnson, G. Leonard; Eckhoff, Oscar B.** Bathymetry of the north Greenland Sea: Deep-Sea Research, v. 13, no. 6, pt. 1, p. 1161–1173, illus., 1966.

A bathymetric chart is presented of the area of the Greenland Sea between lat 74° and 81° N. The Mid-Oceanic Ridge in the area is characterized by a deep rift valley seaward of the Svalbard continental margin. Rift mountains appear west of the rift but are barely discernible on the east and are probably buried by sediment. Between lat 79° and 81° N. the ridge is offset 300 mi to the northwest by the seismically active Spitsbergen fracture zone. The zone strikes northwest across the "Nansen Sill" and appears as a trench off the continental margin of northeastern Greenland. Two other fracture zones, characterized by vertical movements, parallel the Spitsbergen zone to the south. Two abyssal plains at lat 75° and 77° N. are separated by the Greenland fracture zone which causes a 300-fathom depth difference in plain levels.—V.S.N.

10177 **Johnson, H. S., Jr.; Thordarson, William.** Uranium deposits of the Moab, Monticello, White Canyon, and Monument Valley districts, Utah and Arizona: U.S. Geol. Survey Bull. 1222-H, p. H1–H53, illus., table, 1966.

Uranium deposits in the Moab, Monticello, White Canyon, and Monument Valley districts are similar in habit, and probably in origin, to those elsewhere on the

Colorado Plateau; most are elongate tabular bodies in fluvial sandstone and oriented roughly parallel to bedding and sedimentary trends. Primary sedimentary features seem to be principal controls of ore deposits and of favorable ground. Significant ore deposits and appreciable potential reserves are apparently confined to the Chinle (Late Triassic) and Morrison (Late Jurassic) Formations, and possibly to the Permian Cutler Formation. The Chinle has been the source of about 93 percent of total production and contains about 99 percent of reserves. The Morrison, in particular the Salt Wash Member, has been the source of about 7 percent of ore produced and contains about 1 percent of reserves.—*from* Authors' abstract

Johnson, Kenneth G. *See* Friedman, Gerald M. 10070

00127 **Johnson, Stanley S.** Virginia's contribution to the kyanite–mullite industry: Virginia Minerals, v. 13, no. 1, p. 1–7, illus., table, 1967.

In Virginia kyanite occurs in high-grade metamorphic rocks (probably originally aluminum-rich sedimentary rocks) or as hydrothermal mineral in pegmatite; present commercial deposits are in quartzite, gneiss, and schist and are confined to an area in the east-central Piedmont. Mullite was first noted in artificial, high-temperature melts and ceramic porcelains; it was later found to occur naturally as inclusions in lavas on the Island of Mull near Scotland. Approximately 90 percent of mullite (produced mostly from kyanite) consumed annually is used as refractory lining. Physical and chemical properties of kyanite and related minerals are tabulated.—M.C.M.

10290 **Johnson, Stanley S.; Denny, Marion V.; LeVan, D. C.** Analyses of clay, shale and related materials—Southwestern counties: Virginia Div. Mineral Resources, Mineral Resources Rept. 6, 186 p., illus., tables, revised 1966; originally published 1965.

Tests and determinations of properties, including X-ray, spectrographic, and petrographic analyses, were made on 120 samples of clay, shale, and coal refuse to evaluate the potential ceramic and nonceramic uses for material from Bland, Buchanan, Dickenson, Giles, Lee, Pulaski, Russell, Scott, Smyth, Tazewell, Washington, Wise, and Wythe Counties. Results indicate that about 96 samples are suitable for various kinds of brick or tile, 20 for pottery and earthenware, 1 for insulating material, 1 for glazing, 60 for lightweight aggregate, and 1 for aggregate. Studies are of only one or two samples per area, therefore to prove any particular locality for commercial development would require detailed study. [The original report, issued in 1965, was recalled because it contained errors in the laboratory determinations.]—M.C.M.

10075 **Jolliffe, A. W.** Stratigraphy of the Steeprock Group, Steep Rock Lake, Ontario [with French abs.]. *in* Precambrian symposium—The relationship of mineralization to Precambrian stratigraphy in certain mining areas of Ontario and Quebec: Geol. Assoc. Canada Spec. Paper 3, p. 75–98, illus., tables, 1966.

Stratigraphy has provided the most helpful guide in the exploration of iron ore bodies at Steep Rock Lake. Most of the 33 million tons produced has come from a single stratigraphic member within a sedimentary-volcanic sequence of Archean age, herein defined as the Steeprock Group. The Group is divided into the Conglomerate, Dolomite, Orezone, and Ashrock Formations. Deformation has been moderately severe, but thermal alteration effects are negligible. The Orezone Formation has three members: the lower, of variable thickness, is usually below ore grade; most of the middle Goethite Member is of ore grade and contains a pisolitic bauxite; pyrite lenses of sedimentary origin occur along the upper contact of the Orezone. Valency changes in iron and manganese within the Group suggest that its deposition spanned a critical period in atmosphere evolution more than 2,500 m.y. ago.—*from* Author's abstract

10223 **Jones, John F.** Geology and ground water resources of the Peace River district, northwestern Alberta: Research Council Alberta Bull. 16, 143 p., illus., tables, geol. maps, 1966.

In this region of 22,500 sq mi, bedrock strata with ground-water potential are all Cretaceous in age. The stratigraphy described, Peace River through Wapiti Formations, includes thicknesses, lithologies, and outcrops. Post-Cretaceous sands and gravels, in buried channels and extensive beds, are overlain by glacial and recent deposits. Ground-water hydrologic data are sparse and mostly for the Wapiti Formation which provides the most suitable water. Fairly substantial but highly mineralized yields might come from the Baytree Conglomerate or from the Cardium Formation, but the best potential sources are alluvial terrace and buried channel deposits. Lithologic and electric logs are given in appendixes; maps of bedrock geology and surficial deposits are in pocket with other information.—G.D.C.

10272 **Jones, R. W.** Differential vertical uplift—A major factor in the structural evolution of southeast Arizona: Arizona Geol. Soc. Digest, v. 8, p. 97–124, illus., 1966.

The effects of Laramide compression and overthrusting in mountain building in southeast Arizona are thought to be overestimated. It is suggested that structural evolution of many of the ranges has been dominated by effects of differential vertical uplift of Precambrian, Jurassic, and Laramide granites. Locally, effects of strong compression do exist, but they originated from uplift of granites, high-angle faulting, diapiric action, intrusion, and gravity sliding, not from major regional compressive stress systems. Two ranges illustrating these principles, and having wide application in southeast Arizona—the Mule Mountains and the Tombstone Hills—are discussed.—M.S.T.

Jordan, Robert H. *See* Daniels, Raymond B. 10143

Kachadoorian, Reuben. *See* Plafker, George. 10170

Kalvius, Michael. *See* Hafner, Stefan. 10338

10334 **Kane, Julius.** Vector wave diffraction at crustal discontinuities—[Pt.] 1, Basic theory, Rayleigh waves at the continental margin: Royal Astron. Soc. Geophys. Jour., v. 11, nos. 1–2, p. 149–163, illus., 1966.

An elementary procedure is introduced for the solution of problems involving the diffraction of vector fields. In particular, the propagation of Rayleigh waves obliquely incident on the continental margin is discussed. Crustal layering on either side of the coastline is modeled mathematically as a two-part boundary layer in such fashion that the relevant reflection and transmission coefficients emerge as elementary algebraic expressions. The procedure permitting such a solution to be found is to introduce a diffraction analog of the well-known electrical engineering procedure of replacing a transmission line network by a lumped parameter equivalent in a specified frequency or wave number domain.—*from* Author's abstract

10108 **Kane, M. F.; Bromery, R. W.; Pavlides, Louis; Frischknecht, F. C.** Geophysical and geological reconnaissance of the Oakfield Hills area, Maine, *in* Mining geophysics—V. 1, Case histories: Tulsa, Okla., Soc. Explor. Geophysicists, p. 94–104, illus., table, 1966.

The Oakfield Hills lie within a hornfels zone in a region of folded lower Paleozoic rocks that have been intruded and thermally metamorphosed by felsic plutons. An area of prominent aeromagnetic anomalies correlates closely with the hornfels zone. Ground geophysical measurements made in the vicinity of the largest aeromagnetic anomaly have delineated several steeply dipping tabular rock units striking northeast along the northwest margin of one of the felsic plutons. Geophysical and geological evidence indicates that this pluton is the largest of several in the area. The tabular units have a high apparent susceptibility, high density, and in places are conductive. They apparently are lenticular beds of manganese-bearing iron formation that have been thermally metamorphosed to magnetite-bearing rocks by the nearby intrusion. Elsewhere in the area, electromagnetic anomalies are probably caused by sulfide-bearing rocks.—Authors' abstract

10191 **Kanehira, Keiichiro.** A note on the texture of pyrrhotite in some rocks of the Muskox intrusion: Canadian Mineralogist, v. 8, pt. 4, p. 531–536, illus., 1966.

Clusters of pyrrhotite grains with parallel orientation but apparently unconnected were shown to be connected by testing for conduction of an electric current from grain to grain. The poikilitic texture is believed to indicate a slowly cooled immiscible sulfide liquid.—E.H.R.

10066 **Kansas Geological Society; Adkison, W. L.; Veroda, Victor J.** Paleozoic rocks in Kansas. *in* Stratigraphic cross section of Paleozoic rocks—Colorado to New York: Am. Assoc. Petroleum Geologists Cross Sec. Pub. 4, p. 6–17, illus., 1966.

Cross section B–C extends from southwestern Kansas northeastward across the State, and covers parts of the Hugoton embayment, Central Kansas uplift, Sedgwick basin, Salina basin, Nemaha anticline, and Forest City basin. All systems are represented, but parts are missing in large areas. Eighteen well logs are shown, of which ten are composites of two wells. The major structural features and occurrence of oil and gas are discussed briefly.—E.S.L.

Kaplan, Nathan O. *See* Salthe, Stanley N. 09998

10101 **Kaplan, Seymour Fred.** An X-ray diffraction study of some of the naturally occurring iodates [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1986B, 1966.

Kaplar, C. W. *See* Linell, K. A. 10121

10091 **Karlstrom, Thor N. V.** Quaternary glacial record of the north Pacific region and world-wide climatic changes. *in* Pleistocene and post-Pleistocene climatic variations in the Pacific area, a symposium—Pacific Sci. Cong., 10th, Honolulu, 1961: Honolulu, Hawaii, Bishop Mus. Press, p. 153–182, illus., tables, 1966.

Glacial chronology in Alaska is analyzed in relation to Northern Hemisphere dated chronologies, and compared with Pacific equatorial and Southern Hemisphere chronologies. The case is strengthened for: interhemispheric climatic synchronism and cyclicity; usefulness of C-14 and Pa-230 to Th-231 dating; functional validity of traditional Pleistocene classification, and justification for constructing a comparable one for late-glacial and postglacial time. Revisions in concepts suggested are: subdivision of the Pleistocene into five glaciations of 300,000 yrs duration; elimination of two- or three-fold subdivision of the last ice age, and dating the last interglacial at 45,000 B.C.; downgrading of Two Creeks warm interval to a subordinate event; dating maximum postglacial warmth and dryness around 3,500 B.C.; and subdivision of Alaskan interval into a series of cooler and wetter intervals.—E.S.L.

Keen, Martin L. *See* Barr, Donald, 10132

00116 **Keil, Klaus; Snetsinger, K. G.** Niningerite, a new meteoritic sulfide: Science, v. 155, no. 3761, p. 451–453, illus., tables, 1967.

Niningerite, a new meteoritic sulfide ranging in composition from $(Fe_{0.19}Mg_{0.68}Mn_{0.14}Ca_{0.007}Cr_{0.002})S$ to $(Fe_{0.52}Mg_{0.33}Mn_{0.08}Ca_{0.06}Cr_{0.03}Zn_{0.004})S$, from the type-I enstatite chondrites Abee, Saint Sauveur, Adhi-Kot, Indarch, St. Mark's, and Kota-Kota, is described. The composition was determined by electron microprobe analysis. The possible origin of this mineral and the complex mineral assemblage of enstatite chondrites are discussed elsewhere.—D.B.V.

10227 **Keller, G. V.** Dipole method for deep resistivity studies: Geophysics, v. 31, no. 6, p. 1088–1104, illus., 1966.

The dipole method of measuring resistivity is practical for use in studying the electrical properties of the Earth's crust. In such studies, electrical current is driven into the ground with a pair of electrodes spaced a few kilometers apart, and the electric field caused by this current is mapped to distances as great as 100 km. The principal advantage of the dipole method is the relatively small amount of cable which has to be laid out in comparison with that required by other electrode arrays. Sensitivity to lateral inhomogeneities is probably the most serious drawback to the use of dipole methods in crustal resistivity surveys.—*from* Author's abstract

Keller, G. V. *See* Anderson, L. A. 10320

00155 **Kelley, R. W.; Kirkby, E. A.** Sources of geological information in Michigan: Michigan Geol. Survey Circ. 5, 24 p., illus., 1967.

This pamphlet, a revision of Michigan Geol. Survey Circ. 1 (1963), is a guide to the principal sources of information on the geology and mineral resources of Michigan. Brief references are made to the facilities, services, and published materials generally available in the State, and although it is not an exhaustive compilation, it should facilitate the initial search for appropriate materials. Listed are: government agencies, research facilities, publications, libraries, maps, aerial photographs, films and slides, colleges, museums and exhibits, equipment and supplies, identification of rocks, and consulting services.—M.C.M.

09990 **Kelly, Allan O.** A water-impact hypothesis for the Sierra Madera Structure in Texas: Meteoritics, v. 3, no. 2, p. 79–82, illus., 1966.

The Sierra Madera structure consists of a nine-mile basin with a peak of shattered marine sedimentary rock in the center. In 1959, R. S. Dietz found an abundance of shatter cones, indicating meteoritic impact. To solve the question of why rocks in the basin and rim are not shattered as they are in the peak, it is suggested that a large impact might have occurred when the area was covered by a mile or two of ocean.—E.S.L.

10010 **Kelly, T. E.** Geology and ground water resources, Barnes County, North Dakota—Pt. 3, Ground water resources: North Dakota Geol. Survey Bull. 43, pt. 3 (North Dakota Water Conserv. Comm. County Ground Water Study 4), 67 p., illus., tables, 1966.

There are two major types of aquifers in Barnes County, those in consolidated rocks and those in unconsolidated glacial deposits. The Dakota Sandstone is the principal aquifer in the consolidated rocks. Its average artesian flow is less than 10 gpm, but flows exceeding 700 gpm are reported; the water is highly mineralized. Small yields of water are obtained from the Pierre Shale. The Spiritwood is the most productive aquifer of the unconsolidated glacial deposits; individual well yields of 1,000 gpm are available locally and water is generally of good quality. There are numerous other glacial aquifers in the county. Only Valley City and Kathryn have adequate supplies of good-quality water. Several other communities have suitable ground-water supplies potentially available to them, but these are not yet developed.—*from* Author's abstract

10130 **Kempe, D. R. C.** A note on the $\bar{2}01$ spacing of some lime-rich alkali feldspars from Kangerdlugssuaq, East Greenland: Mineralog. Mag., v. 35, no. 273, p. 704–714, illus., tables, 1966.

The values of $2\theta\bar{2}01$ for some homogenized lime-rich fine microperthites from the Kangerdlugssuaq alkaline intrusion, East Greenland, are investigated and found to be consistently high when compared with the values used in the standard curves for estimating the Or content of alkali feldspars. This deviation, which is approximately proportional to anorthite content, results in anomalously low Or percentages being obtained and is ascribed to a distortion of the structure due to the unusually high calcium content of the microperthites.—Author's abstract

Kennedy, John F. *See* Blench, Thomas, 00305

00182 **Kepferle, Roy C.** Geologic map of the Colesburg quadrangle, Hardin and Bullitt Counties, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-602, scale 1:24,000, section, text, 1967.

Although no oil or gas was mentioned in logs of eight exploratory holes drilled in the Colesburg quadrangle, during mapping gas was observed bubbling from a creek in the southeastern section. Limestone for road metal, sub-grade, and fill has been quarried from the Harrodsburg Limestone and from the Muldraugh Member of the Borden Formation; no quarries were active in 1965. Clay from the Borden may be suitable for some purposes. Water for domestic and farm use

is obtained from wells in alluvium and from wells and springs in the St. Louis, Salem, and Harrodsburg Limestones; other potential aquifers are in the Muldraugh Member of the Borden and in gravel underlying lacustrine deposits.—M.C.M.

10325 **Keyser, J. Hode.** La géologie de Montréal [with English summ]. *in* Internat. Conf. Soil Mechanics and Found. Eng., 6th Montreal, 1965, Proc., V. 3: Toronto, Ontario, Univ. Toronto Press, p. 114–133, illus., tables, 1966.

The Island of Montreal is part of the St. Lawrence Lowland, and is in the physiographic region of Quebec. Precambrian igneous and metamorphic rocks underlie Paleozoic limestone, shale, and sandstone beds. Mount Royal, and the dikes and breccias of the region were formed in the Paleocene era of igneous activity. Locally the rock is a source of construction materials. Engineering problems are discussed, particularly for construction of the subway tunnel. The soils are almost all of glacial origin—basal till, fluvioglacial deposits, superglacial till, deposits of the Champlain Sea, alluvial sediments, and marshy deposits. The procedure for preparing geologic maps and the practical application of these data are described.—G.D.C.

00195 **Khayatt, Amir.** Stress–dilatancy performance of feldspar—Discussion [of paper 4734 by I. K. Lee, 1966]: Am. Soc. Civil Engineers Proc., v. 93, Jour. Soil Mechanics and Found. Div., no. SM 1, p. 148–151, illus., 1967.

The stress–dilatancy performance of sand on reloading in the post-peak region in a triaxial apparatus is analyzed. A system of direct measurement of the components must be used, especially where incremental stress and strain values are involved. A cycling test on dense fine sand showed performance in accordance with the minimum energy criterion.—J.W.C.

Kirkby, E. A. *See* Kelley, R. W. 00155

00207 **Kissling, Don L.; Lineback, Jerry A.** Paleoecological analysis of corals and stromatoporoids in a Devonian biostrome, Falls of the Ohio, Kentucky–Indiana: Geol. Soc. America Bull., v. 78, no. 2, p. 157–174, illus., tables, 1967.

A single broadly exposed bedding surface in the coral zone of the Middle Devonian Jeffersonville Limestone displays a virtually in situ contemporary population of colonial corals and stromatoporoids. The positions, sizes, shapes, orientations, and subfamilial or generic identities of 14,233 unbroken colonial coelenterates were recorded. The fauna consists of 70.8 percent tabulate corals, 25.5 percent stromatoporoids, and 3.8 percent compound rugose corals. Distribution and preferred orientations suggest that a gentle east–west tidal current, with a stronger easterly component, was responsible for the orientation.—J.P.A.

Kisslinger, Carl. *See* Gupta, Indra N. 10176

10033 **Klassen, Rudolph Waldemar.** The surficial geology of the Riding Mountain area, Manitoba–Saskatchewan [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1986B, 1966.

10012 **Klausing, Robert L.** Geology and ground water resources of Cass County, North Dakota—Pt. 2, Ground water basic data: North Dakota Geol. Survey Bull. 47, pt. 2 (North Dakota Water Conserv. Comm. County Ground Water Study 8), 158 p., illus., tables, 1966.

Part 1 of this bulletin will be the interpretive report describing the geology of Cass County, and part 3 the description of the ground-water resources. Part 2 makes available data collected during the investigations, and functions as a reference for the other sections; it contains data on about 1,600 wells, springs, and test holes; water-level measurements in 140 observation wells; chemical analyses of 151 water samples; and logs of about 150 test holes and selected wells. Maps in pocket show location of wells and springs and test holes.—M.C.M.

Klemic, Harry. *See* Ulrich, George E. 10225

Kleppa, O. J. *See* Holm, J. L. 10141

10327 **Kluge, Arnold G.** A new pelobatine frog from the Lower Miocene of South Dakota with a discussion of the evolution of the *Scaphiopus–Spea complex: Los Angeles County Mus. Contr. Sci., no. 113, 26 p., illus., tables, 1966.*

A new species of pelobatid frog, Scaphiopus neuter, is described from the Lower Miocene [Sharps Formation] of the Wounded Knee area of South Dakota. The new species is a member of the Pelobatinae and it appears to lie within the genus *Scaphiopus.* Many of the characteristics of the fossil suggest that it is near the point of divergence of the subgenera *Scaphiopus* and *Spea.* Skeletal variation in Recent species of *Pelobates* and *Scaphiopus* is described as it relates to the taxonomic assignment of the fossil.—Author's abstract

00137 **Klugman, M. A.** Reply [to 1967 discussion by A. F. Hagner of "Resume of the geology of the Laramie anorthosite mass," 1966]: Mtn. Geologist, v. 4, no. 1, p. 36, 1967.

In reply to Hagner's discussion (ibid., p. 35–36) of Klugman's original paper (ibid., v. 3, no. 2, p. 75–84, 1966), Klugman points out that the opinion that the anorthosite is a metasomatic rock was obtained from conversations with Hagner and with Newhouse in 1959. Based on detailed field mapping, Klugman is of the opinion that the mass is of a magmatic origin rather than metasomatic.—M.C.M.

10310 **Knittel, Dewey.** The Antelope Valley Freeway, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 132–135, illus., 1966.

A typical case history illustrating the use of geology in the location, design, and construction of a freeway in mountainous terrain is furnished by the Antelope Valley Freeway in Los Angeles County, Calif. The area is within the Soledad basin and repeated diastrophism is manifest. Formations exposed range from Jurassic to Recent; terrace deposits occur throughout the project. Several proposed alinements were submitted and the basic geology mapped. Recommendations were made to abandon certain lines because of unfavorable geology, and for shifting parts of others to take advantage of the geology. Cut slope recommendations, local materials sources, and a full materials report were submitted, and the geology along the basic alinement mapped in detail.—E.S.L.

Knopoff, Leon. *See* Hudson, J. A. 10333

Knox, James G. *See* McConnell, Harold, 00140

10007 **Kobayashi, Kazuo; Schwarz, E. J.** Magnetic properties of the contact zone between Upper Triassic red beds and basalt in Connecticut: Jour. Geophys. Research, v. 71, no. 22, p. 5357–5364, illus., table, 1966.

Results are presented of thermomagnetic analyses of 15 samples from red sediments and an overlying basalt near Middletown, Conn., at temperatures between −190°C and 620°C in air either of normal pressure or of 10^{-3} torr. Considering the results obtained from low-temperature work and the intensity of remanent magnetization, it is concluded that Fe_2O_3 was formed in the sediments up to about 40 cm from the basalt during cooling. Part of the magnetization appears to be chemical remanent magnetization. Results of a–c demagnetization suggest a geomagnetic field reversal in Late Triassic time.—D.B.V.

10065 **Koenig, John W.; Missouri Div. Geol. Survey.** (and Water Resources). Paleozoic rocks in northern Missouri, *in* Stratigraphic cross section of Paleozoic rocks Colorado to New York: Am. Assoc. Petroleum Geologists Cross Sec. Pub. 4, p. 18–25, illus., 1966.

The deepest wells, within the limits specified for the national cross section, determined the line of cross section C–D. Fourteen well logs, some of which are composite, are used. Four tectonic features are crossed: the Forest City basin, Saline

County arch, Brown's Station anticline, and Lincoln fold. All systems except Permian are represented, but many parts of some are absent.—E.S.L.

00291 **Kohls, Donald W.** Petrology of the Simsboro Formation of northeastern central Texas: Jour. Sed. Petrology, v. 37, no. 1, p. 184–204, 1967.

The Lower Eocene Simsboro Formation of the Wilcox Group is a fluviatile continental deposit which grades southward into marine and beach facies. Sediment forming the strata moved southward from source areas in the Ouachita Mountains, continental interior and southern Appalachian areas. The resulting rocks are classified as quartzose subgraywacke, orthoquartzite, and subarkose. Conditions which produced the formation included uplift, moderate relief and humid climate in the source areas; and deposition on a humid, subsiding coastal plain.—R.A.C.

10049 **Kolb, Charles R.; VanLopik, Jack R.** Depositional environments of the Mississippi River deltaic plain—Southeastern Louisiana, *in* Deltas in their geologic framework: Houston, Tex., Houston Geol. Soc., p. 17–61, illus., tables, 1966.

Seaward progradation of the land surface by the present and former Mississippi River deltas has created the Recent deltaic plain of southeastern Louisiana. Course changes and accompanying shifts in centers of deposition have resulted in the distribution of deltaic sediments along a 200-mile arc. Marine transgression begins as soon as a delta is abandoned, aided by tectonic subsidence and consolidation of sediments; however, the net result is increase in size of the Recent deltaic plain. Pleistocene deposits are reviewed, and a map showing contours on top of the Pleistocene is included. Four major depositional environments are complexly interfingered—fluvial, fluvial–marine, paludal, and marine. Processes active within each, and the distribution and physical properties of the deposits are discussed and summarized in a table.—E.S.L.

10089 **Koneeny, G.; Faig, W.** Studies of ice movements on the Ward Hunt Ice Shelf by means of triangulation–trilateration [with French and Russian abs.]: Arctic, v. 19, no. 4, p. 337–342, illus., tables, 1966.

A method is described by which accurate measurements of ice movement were performed on the Ward Hunt Ice Shelf at Ward Hunt Island. Geodimeter distance measurements and angular theodolite measurements were combined in a system of triangulation–trilateration in the form of a chain of quadrilaterals to achieve relative positioning accuracies of ±1 to 2 cm for the survey markers drilled into the shelf ice. Shelf ice movements of 30 cm with respect to solid ground were obtained between 1964 and 1965. The relative position change between the markers on shelf ice was less than 4 cm. Experience on this first known arctic application of the geodimeter are reported.—Authors' abstract

10095 **Koyanagi, Robert Y.; Krivoy, Harold L.; Okamura, Arnold I.** The 1962 Kaoiki, Hawaii, earthquake and its aftershocks: Seismol. Soc. America Bull., v. 56, no. 6, p. 1317–1335, illus., tables, 1966.

At 18:27:14.3 on June 27, 1962, an earthquake of moderate intensity occurred near the Kaoiki fault system between the volcanoes Kilauea and Mauna Loa on the Island of Hawaii. It was felt strongly on Hawaii, where it caused minor property damage, and was perceptible as far as Oahu to the northwest. Intense aftershock activity continued for several weeks; 1,540 aftershocks were recorded during the initial 60 hours. A hyperbolic decay in the number of aftershocks with increasing time was evident. The epicentral zone covered about 150 sq km and focal depths ranged from 3 to 12 km.—Authors' abstract

10246 **Krazynski, Leonard M.; Lee, Louis J.** Identification and testing of expansive soils, *in* Seminar on "The importance of the earth sciences to the public works and building official," Anaheim, Calif., 1966: Glendale, Calif., Assoc. Eng. Geologists, Los Angeles Sec., p. 100–171, illus., 1966.

This paper presents a summary of the existing identification tests and classification methods for potentially expansive soils, the quantitative methods for evaluation and engineering analyses of such soils and the more prominent factors which affect the

results of laboratory swell tests. Some individual aspects of these main topics are discussed in an abbreviated manner and references are given to sources of more complete treatments of these subjects. The opinions of the authors of this paper are included in the discussion of individual topics and are summarized in conclusions.—Authors' abstract

10306 **Kresse, Frank C.** Baldwin Hills Reservoir failure of 1963, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 92–103, illus., geol. map, 1966.

The reservoir, a four-sided basin carved out of a hilltop in the Baldwin Hills, Los Angeles, went into service in 1951 and failed 12 years later, causing 15 million dollars in damages. The Hills are part of the Newport–Inglewood uplift, along which Tertiary and Pleistocene units are exposed; these units are aquifers and reservoirs for oil and gas trapped by domes and faulting. Seven minor faults crossed the reservoir, cracks in which were checked periodically. About nine feet of subsidence occurred between 1917 and 1962, and earth cracks had opened at several locations since 1957. After failure, an open crack extended from the breach across the floor and up the south slope, with about two inches of vertical movement. Exploration revealed a number of tensional open cracks leaving voids under the floor of the reservoir.—E.S.L.

Krivoy, Harold L. *See* Koyanagi, Robert Y. 10095

Krogh, T. E. *See* Hart, S. R. 00158

Laird, Wilson M. *See* Tuthill, Samuel J. 10146

Lamke, Robert D. *See* Eakin, Thomas E. 10182

00225 **Larochelle, A.** A re-examination of certain statistical methods in palaeomagnetism: Canada Geol. Survey Paper 67–18, 15 p., tables, 1967.

Statistical methods in the field of palaeomagnetism are discussed for the geologist and geophysicist. A novel approach is used to derive expressions giving estimates of the angular variance and of the angular standard deviation of a population on the basis of a sample of size N drawn randomly from the population. Tests of significance based on these definitions are described which turn out to be identical to those previously described by Watson for the particular case in which the vectors have a fisherian distribution. A numerical example is worked out to illustrate the application of the tests.—Author's abstract

10295 **Larrabee, David M.** Map showing distribution of ultramafic and intrusive mafic rocks from northern New Jersey to eastern Alabama: U.S. Geol. Survey Misc. Geol. Inv. Map I–476, 3 sheets, scale 1:500,000, text, 1966.

This map showing the distribution of ultramafic and intrusive mafic rocks from the Hudson River to eastern Alabama was compiled to show areal distribution of the rocks at a scale that would be usable with State geologic maps. The overall pattern is believed to portray accurately present knowledge of distribution of the ultramafic rocks. Mineral commodities related to them include asbestos, chromite, corundum (including some gem varieties and emery), nickel, olivine, soapstone, talc, and vermiculite. Terminology followed in the compilation is outlined and an extensive bibliography is included.—M.C.M.

10034 **Larson, Allan Richard.** Stratigraphy and paleontology of the Moenkopi Formation in southern Nevada [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1987B, 1966.

10085 **Larson, Lawrence T.** Mineral resources summary of the Purdy quadrangle, Tennessee: Nashville, Tenn., Tennessee Div. Geology, 5 p., 1966.

The sand and clay resources are described in this accompanying text to Tennessee Div. Geology Geol. Map GM 4-NE, by E. E. Russell, 1966 (cited separately). Of the 10 sand pits, or sand and clay combined (all currently inactive), nine are

in the McNairy Sand and one is in the Coon Creek Formation. The McNairy is 140 feet thick northwest of Selmer and thins to the east; the Coon Creek is more than 120 feet thick in the eastern part. Heavy minerals are a possible resource in the extensive area covered with 40–140 feet of McNairy Sand.—M.C.M.

10160 **Lasca, N. P.** Postglacial delevelling in Skeldal, Northeast Greenland [with French and Russian abs.]: Arctic, v. 19, no. 4, p. 349–353, illus., table, 1966.

Thirteen radiocarbon dates of shell material were used to establish a rate of emergence in Skeldal, Mesters Vig district, Northeast Greenland, as delevelling occurred. The dates indicate that Skeldal was partially open to the sea by c 8,500 B.P. Early emergence (8,000–7,000 B.P.) was approximately 3 m per century. Emergence is related almost entirely to isostatic adjustment due to glacial unloading.—Author's abstract

10073 **Latulippe, Maurice.** The relationship of mineralization to Precambrian stratigraphy in the Matagami Lake and Val d'Or districts of Quebec [with French abs.], *in* Precambrian symposium—The relationship of mineralization to Precambrian stratigraphy in certain mining areas of Ontario and Quebec: Geol. Assoc. Canada Spec. Paper 3, p. 21–42, illus., 1966.

Broad patterns of mineralization are evident in the Archaean rocks of the Matagami Lake–Val d'Or districts. These patterns can be related to stratigraphic units or groups of units. In many cases evidence of relationship is indirect. Copper–zinc sulphide deposits appear to be related to siliceous phases of vulcanism. Gold mineralization is related to late phases of sub–volcanic intrusive activity in the upper part of extensive volcanic sequences. Pegmatitic and nickel mineralization can be linked directly with intrusive stratigraphic units.—Author's abstract

10211 **Laura, Patricio A.** Analytical determination of stresses around mine shafts of arbitrary cross section [with French and German abs.], *in* Internat. Soc. Rock Mechanics Congress, 1st, Lisbon, 1966, Proc., V. 2: Lisbon, Portugal, Laboratório Nacional Engenharia Civil, p. 313–316, illus., table, 1966.

Determination of the mapping function which maps the outside of the unit circle in one plane onto the given shape in the other plane is the most difficult part of the problem of stress analysis of an infinite medium with a hole of arbitrary cross section when uniform pressure is applied at infinity. The approach involves the numerical solution of an integral equation, but in some cases a simpler technique can be used. Stress and displacements can be determined easily once the mapping function is known. A table of mapping function coefficients is given for all cases cited.—V.S.N.

00134 **LaValle, Placido.** Some aspects of linear karst depression development in south central Kentucky: Assoc. Am. Geographers Annals, v. 57, no. 1, p. 49–71, tables, 1967.

Spatial patterns of karst depression elongation, the ratio of long to short axes, and depression orientation, the azimuth of the long axis relative to structural trends, are analyzed. It was found that depression elongation ratios were greatest where insoluble limestone residues are low, where karst relief ratios and hydraulic gradients are high, where limestone is dense, at localities near the mouths of drainage systems, and most important, where there is a high proportion of structurally aligned depressions. Structurally aligned depressions are most frequent in areas where limestones have low insoluble residue content, where hydraulic gradients and, consequently, karst relief ratios are high, where surface runoff is concentrated in subterranean drainage systems, and near the mouths of subterranean drainage systems.—*from* Author's abstract

00139 **LaValle, Placido.** A multivariate study of relative karst morphology in Kentucky [abs.]: Assoc. Am. Geographers Annals, v. 57, no. 1, p. 181, 1967.

00261 **Lawrence, David Reed.** The oysters *Crassostrea gigantissima* (Finch) at Belgrade, North Carolina—A case study in paleoecology [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2413B–2414B, 1967.

10125 **Lawson, Harold J.** The "Rock Cut" lower St. Marys River, Michigan [abs.], *in* Inst. Lake Superior Geology, 12th Ann., 1966: Sault Ste. Marie, Mich., Michigan Technol. Univ., p. 13, 1966.

10284 **Lea, Graham.** Factor analysis as an exploration tool: Oilweek, v. 17, no. 42, p. 22, 24, 27, 30, illus., tables, 1966.

Much time and money have been spent on developing information retrieval systems, but too little attention has been given to the analysis of this data. It is difficult to construct a mathematical geologic model. A conceptual model is required first, and factor analysis separates the significant factors from the large volume of data. The method of doing this, using Q-mode or R-mode analysis, is described briefly, and results for a typical problem are tabulated. Factor analysis can be carried out only on larger computers but can play a major part in the prediction of hydrocarbon deposits.—E.S.L.

Lee, Louis J. *See* Krazynski, Leonard M. 10246

10336 **Leeds, David J.** Engineering seismology in southern California, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 35–53, illus., 1966.

Ten techniques to develop a design earthquake, a best guess of the most likely earthquake to which a given site will be exposed, are given. Two geologic methods are borings, to determine the physical properties of soil and rock materials, and mapping, to indicate special features of interest. Geophysical methods described include use of seismograph records, strong-motion accelerograms, refraction and uphole seismic surveys, microtremor and forced vibration surveys, and amplification and ground-motion spectra. Monitoring of industrial vibration also should be included in engineering seismology.—E.S.L.

LeGrand, H. E. *See* Stringfield, V. T: 10300

10229 **Leighton, F. Beach.** Landslides and hillside development, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 149–193, 201–206, illus., tables, 1966.

The field geology of hillside projects generally proceeds in four stages: planning and reconnaissance, detailed mapping, subsurface exploration, and in-grading inspections combining all the others. Behind the scenes of landslide ills, publicized and unpublicized, there have been triumphs of hillside stability in some of the most landslide-prone terrains. Three primary safeguards for the homeowner are: that thorough geologic and soils investigations have been conducted before and during development and that recommendations have been followed, that the hillside community has a strong building code, and that information is available for maintenance of stability.—E.S.L.

10230 **Leighton, F. Beach.** Preliminary map showing landslide locations in a portion of southern California, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 194–200, illus., 1966.

The preliminary map shows the distribution of known landslides over 100 feet in largest dimension, and records the topographic and geologic setting of over 3,000 slides already mapped in southern California. Sources of landslide data were published geologic maps, and thesis and research materials. Slides not shown include those under 100 feet, pre-Pleistocene slides, tectonic blocks, soil creep, subsidence, and those not recorded by geologic mapping. Types of slides, their geologic setting, and structural control are reviewed.—E.S.L.

Lemay, William J. *See* Gratton, Patrick J. F. 00110

10117 **Leney, George W.** Field studies in iron ore geophysics, *in* Mining geophysics—V. I, Case histories: Tulsa, Okla., Soc. Explor. Geophysicists, p. 391–417, illus., revised 1966; originally published 1964.

Iron ores occur in such a wide variety of forms that almost any geophysical technique can find some application in the search for them. Magnetic mapping is the primary tool and surveys can be used for direct discovery of new ore, for mapping stratigraphy and structure, and for mapping ore types. Uses of gravity may be grouped in four classes: providing supplementary information on location and structure, giving indications of gross tonnage, in regional prospecting, and for direct discovery of nonmagnetic hard ore bodies. Electrical methods have restricted but useful applications. Examples of various types of surveys are presented to illustrate where they might be applied and the kind of information that can be obtained.—*from* Author's abstract

LeVan, D. C. *See* Johnson, Stanley S. 10290

10102 **Levi Levi, Silvana.** Cartas mineras y petrolera de México, 1960 [with English summ.]: México Univ. Nac. Anuario Geografía 1964, v. 4, p. 171–243, illus., tables, 1966.

The colonial economy of Mexico was based on mining, which at present has lost its importance in favor of industry and agriculture, but production is gaining. Based on statistics for 1961, maps show production areas and probabilities for silver and gold; zinc and lead; copper and mercury; manganese, antimony and graphite; iron and coal; petroleum; sulfur, kaolin, barite, and fluorite; gypsum and limestone. Mexico has led the world production of silver since 1521, and formerly discarded ore is now processed for mercury as well as gold and silver. Most lead–zinc ore comes from Chihuahua and Zacatecas, copper mainly from Cananea, Sonora, and southern Chihuahua, and iron from Durango and Chihuahua. Some coal is found north of Coahuila, but there are no great mines. Petroleum is obtained in the coastal lowlands of the Gulf of Mexico.—G.D.C.

10188 **Lewis, C. F. M.; Anderson, T. W.; Berti, A. A.** Geological and palynological studies of Early Lake Erie deposits, *in* Great Lakes Research, 9th Conf., Chicago, 1966, Proc.: Michigan Univ. Great Lakes Research Div. Pub. 15, p. 176–191, illus., 1966.

Coring and echo sounding of Lake Erie bottom sediments indicate a thin lag concentrate of sand, with fossils in places, underlying Recent silty clay muds, and overlying clay till or late-glacial lacustrine clays. Buried shallow pond organic sediments in the western basin, and relict beach deposits, terraces, and intrabasinal channels, in the central basin, all indicate water levels much below present. C–14 dates of 10,200 and 11,300 B.P. on the organic material, suggest that Early Lake Erie came into existence about 12,400 yr ago. Water levels were 100 feet lower than at present, but rose rapidly as the outlet area was uplifted isostatically and probably reached present level 9,000 to 10,000 yr ago. Palynology studies of cores, and diagram correlation, indicate continuous undisturbed sedimentation since the low level, support geologic evidence for a low lake stage, and provide a means of dating non-organic sediments.—E.S.L.

10169 **Li, Paulina; Caldwell, A. C.** The oxidation of elemental sulfur in soil: Soil Sci. Soc. America Proc., v. 30, no. 3, p. 370–372, tables, 1966.

Incubation studies were conducted to measure the rate of elemental S oxidation in a Dorset sandy loam soil. This rate was significantly affected by particle size and temperature. Greatest oxidation occurred with particle sizes of less than 100 mesh, and at temperatures of 30°C and 40°C. The oxidation was accelerated by inoculation with *Thiobacillus thiooxidans.*—Editor's summary

Liang, W. L. *See* Nawar, F. G. 10135

10158 **Lindsley, D. H.** Melting relations of $KAlSi_3O_8$—Effect of pressures up to 40 kilobars: Am. Mineralogist, v. 51, nos. 11–12, p. 1793–1799, illus., tables, 1966.

The leucite-plus-liquid field disappears at a singular point at 19 kb and 1445°C where the curves sanidine = leucite + liquid, sanidine = liquid, and sanidine + leucite = liquid melt. The last of these was not encountered with the

composition being investigated, but is inferred. The second curve is concave toward the pressure axis reaching about 1540° at 40 kb.—E.H.R.

Lineback, Jerry A. *See* Kissling, Don L. 00207

10121 **Linell, K. A.; Kaplar, C. W.** Description and classification of frozen soils, App. A *in* Cold regions science and engineering—Pt. 1, Sec. A2, Permafrost (perennially frozen ground): Hanover, N. H., U.S. Army Materiel Command, Cold Regions Research and Eng. Lab., p. 71–77, illus., tables, 1966.

A frozen soil description and classification system that is independent of geologic history or mode of origin, and capable of easy expansion or contraction is summarized in a table. Photographs illustrate soil types.—E.S.L.

10317 **Lissey, A.; Wyder, J. E.** Interbasinal groundwater flow, Oak River, Manitoba: Canada Geol. Survey Paper 65–23, 16 p., illus., tables, 1966.

A successful combination of geophysical and hydrogeologic techniques has been used to demonstrate that ground water can flow between the Salt Lake and Oak River drainage basins in Manitoba. Surface resistivity techniques were used to locate a buried bedrock channel, filled with gravel, even though both surface and ground waters were saline; resulting data are tabulated. Test drilling was combined with the resistivity survey, and logs are given in an appendix.—E.S.L.

Lomenick, T. F. *See* Bradshaw, R. L. 10192

10133 **Loomis, B. F.** Pictorial history of the Lassen volcano (2d revised edition) (Eruptions of Lassen Peak—A photo story of a volcano): Mineral, Calif., Loomis Mus. Assoc., 100 p., illus., 1966; originally published 1926.

A first-hand account, in popular language, of the 1914–1915 eruptions of Lassen Peak, California, is combined with newspaper accounts, and illustrated by photographs. The origin of the mudflows of May 19, 1915, seems to be a lava tongue through the northeast notch that melted the snow.—E.S.L.

10269 **Lootens, Douglas J.** Geology and structural environment of the Sierrita Mountains, Pima County, Arizona: Arizona Geol. Soc. Digest, v. 8, p. 33–56, illus., geol. map, 1966.

The Sierrita Mountains were mapped in detail, with special attention to areas of significant structural interest and their relation to mineralization. Structural elements defined include (1) post-volcanic, pre-intrusive east-west compressional force producing northwesterly-trending, high angle wrench faults, (2) a similar post-intrusive east-west compressive episode producing northeasterly trending wrench faults, and (3) domal uplift with intrusive emplacement which tilted the volcanics and produced north-trending faults east of the range. Mineralization ranges from extensive porphyry copper-type concentrations to small high-grade veins of lead, copper, silver, and gold.—*from* Author's summary

Love, J. D. *See* Antweiler, J. C. 00211

Lucia, F. J. *See* Murray, R. C. 00281

10282 **Lung, Richard; Proctor, Richard.** (editors). Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), 389 p., illus., tables, geol. map, 1966.

The publication is divided into 12 chapters, each with several papers, a bibliography, and case histories. Papers are cited individually from all but three of these chapters. Chapter headings are: earthquakes and faults; aqueducts, dams, and tunnels; highways and freeways; landslides and urban development; legal aspects of engineering geology; grading codes; ground water; subsidence; flood control; marine geology and beach erosion; foundations, soil mechanics, and rock mechanics; and nuclear reactor siting. Maps accompanying the publication show major geologic

and engineering features, landslides in a portion of the area, and soil and bedrock distribution in the greater Los Angeles area.—E.S.L.

10109 **Mabey, Don R.** Regional gravity and magnetic anomalies in part of Eureka County, Nevada, *in* Mining geophysics—V. 1, Case histories: Tulsa, Okla., Soc. Explor. Geophysicists, p. 77–83, illus., 1966.

A regional gravity survey of part of Eureka County, Nev., reveals a 50-mgal gravity low over Pine Valley. This low is interpreted as indicating that about 12,000 feet of low density rock of Cenozoic, and perhaps Cretaceous, age underlie the central part of the valley. Smaller anomalies occur over the appended valleys to the south and southwest. The dominant aeromagnetic anomaly over this area is a 500-gamma high trending about 16° west of north. This high is related to a swarm of basalt dikes of Tertiary age. Smaller magnetic anomalies are associated with granitic intrusive bodies and volcanic rocks.—Author's abstract

10244 **MacFadyen, Charles R.** Grading control procedures, *in* Seminar on "The importance of the earth sciences to the public works and building official," Anaheim, Calif., 1966: Glendale, Calif., Assoc. Eng. Geologists, Los Angeles Sec., p. 33–64, 1966.

Grading control, as used here, is defined as the soils engineering and geologic investigation, analysis, testing, inspection and observation to ensure cut and fill graded building sites for safe and adequate use. Scientific study of soil and rock behavior, as well as development of larger and more efficient earth moving equipment, has led to more massive grading projects. Preliminary soils and geologic reports should be prepared by the controlling firm, with full understanding of the related technical aspects of the project, considering soil and bedrock materials, topography and surface deposits, substructure, slope stability, and weathering features. Experienced and well trained grading technicians should be carefully supervised, and the soils engineer advised by competent geologists.—G.D.C.

10285 **Mackenzie, Fred T.; Garrels, Robert M.** Silica–bicarbonate balance in the ocean and early diagenesis: Jour. Sed. Petrology, v. 36, no. 4, p. 1075–1084, illus., 1966.

The present rate of delivery of dissolved silica to the ocean would produce a much greater volume of sediments than is observed in the geologic column if all this silica were precipitated as free SiO_2. If the silica and bicarbonate in the oceans react to form CO_2 and reactive silica, further reactions can take place that form aluminum silicates of the general clay mineral type and the CO_2 is cycled back to the atmosphere. This may be termed "reverse weathering" and implies that the bulk of allogenic clay minerals entering sea water should not be much altered in composition.—H.A.T.

10035 **MacKenzie, Warren Stuart.** The geology of the Southesk–Cairn carbonate complex (V. 1–3) [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1987B–1988B, 1966.

09954 **MacLean, Brian.** (compiler). Alberta and northeastern British Columbia, showing oil and gas fields and oil and gas discoveries, information to January 1, 1966: Canada Geol. Survey Map 1039A, 12th edition, scale 1:1,267,200, 1966.

60262 **MacNish, Robert Dick.** The Cenozoic history of the Wet Mountain Valley, Colorado [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2414B, 1967.

60263 **Madkour, Mohamed Fathi.** On the gravity anomaly above the Earth and its attenuation [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2414B–2415B, 1967.

09945 **Maglio, Vincent Joseph.** A revision of the fossil selenodont artiodactyls from the middle Miocene Thomas Farm, Gilchrist County, Florida: Breviora, no. 255, 27 p., illus., tables, 1966.

Six species of Ruminantia from the Hawthorne Formation, representing Camelidae, Protoceratidae, Merycoidontidae (oreodonts), and Cervidae, are redescribed or

discussed from new material, mainly teeth. *Floridatragulus and Nothokemas*, formerly considered hypertragulids, are placed in Camelidae—the former in Floridatragulinae, n. subfam., which is diagnosed; the latter in Alticamelinae. The protoceratid *Synthoceras (Prosynthetoceras) rileyi australis* is given subspecies rank. Oreodont fragments, the first discovered in Florida, are tentatively referred to *Merychyus*. *Blastomeryx (Parablastomeryx) floridanus*, placed in Cervidae, is discussed from many new specimens. Closely related forms in Texas and western U.S. indicate land connection between Florida and the mainland during the early Miocene.—V.M.J.

10185 **Malkus, W. V. R.** Precessional torques and Earth rotation, *in* The Earth–Moon system—Internat. Conf., Goddard Space Flight Center, NASA, 1964, Proc.: New York, Plenum Press, p. 26–32, illus., 1966.

Malkus' 1963 paper, primarily concerned with mechanisms by which motion of the Earth's core can be coupled to that of the mantle, is summarized and some of the experiments suggested in the paper are discussed. Malkus supports a magnetohydrodynamic coupling.—V.S.N.

10202 **Malmberg, G. T.; Worts, G. F., Jr.** The effects of pumping on the hydrology of Kings River valley, Humboldt County, Nevada, 1957–64: Nevada Dept. Conserv. and Nat. Resources Water Resources Bull. 31, 53 p., illus., tables, geol. map, 1966.

Kings River valley is a structural depression between the Bilk Creek and Quinn River Mts. The valley floor consists of alluvial fans and talus slopes, beaches, terraces, and related shoreline features, and an alluvial plain. Principal lithologic units are Cretaceous–Tertiary consolidated rocks and Quaternary alluvium. General direction of ground-water flow is from areas of recharge around the valley sides to discharge areas along Quinn River and in areas of evapotranspiration and pumping. Ground-water recharge to the valley-fill reservoir is principally by seepage loss from streams. Chemical quality of water generally has been satisfactory. If all permitted rights to pump water were exercised, net pumping draft would be more than three times estimated yield.—M.C.M.

Maloney, Neil J. *See* Byrne, John V. 10009

10172 **Mandelbaum, Hugo.** Sedimentation in the St. Clair River delta, *in* Great Lakes Research, 9th Conf., Chicago, 1966, Proc.: Michigan Univ. Great Lakes Research Div. Pub. 15, p. 192–202, illus., tables, 1966.

Six hundred and eighty sediment samples from 124 cores, taken in the area north of the St. Clair Flats Channel [Michigan], are analyzed and their parameter distribution studied. The average grain size of the deltaic sediment is 0.11 mm, but all parameters of the size distribution of grains show a wide range of variation. The areal distribution of skew parameters shows significant tendencies for the upper and lower ends of the bays. It is concluded that the solid material brought by the main channels into the delta area is much finer than the average delta sediment and that only about two-thirds of this material is retained as permanent sediments in the delta.—*from* Author's abstract

10233 **Mann, John F., Jr.** Ground water in southern California, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 239–264, illus., 1966.

The first part of the chapter discusses the ground-water geology of the major basins, shown on plates. The highest-standing fault blocks in southern California are usually Lower Cretaceous or older, the intermediate, Tertiary or lower Pleistocene, and the low-standing blocks are covered with Pliocene–Recent erosional debris, constituting the most important aquifers. Santa Barbara and Ventura Counties both have four ground-water basins. The South Coastal Basin is divided into the coastal plain with three basins, and with six inland valley basins. San Diego County has a rather limited ground-water supply. Almost everywhere in Imperial County, ground water is highly mineralized. In the desert regions, ground water occurs most abundantly in Recent alluvium and in Pleistocene alluvial deposits in major

and minor basins. The second part of the chapter discusses ground-water management in southern California.—E.S.L.

10303 **Marek, Charles E.; Moore, Return F.** Foundations for highway structures, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 122–128, illus., 1966.

The first phase in the conduct of a foundation study for highway structures consists of an understanding of the area's general geology; the second of ascertaining physical characteristics, scour conditions, weathering, formational features, and other physical aspects of the site. Studies are made with rotary sample borings, penetration tests, and seismic and resistivity profiles. Information is used to determine the best and most economical foundation support for a given site. Changes in stream gradient, either natural or manmade, can affect bridge foundations. Examples are given for foundation treatment for the Santa Monica Freeway Viaduct, Vincent Thoms Bridge, and Crestline Viaduct, all in southern California.—E.S.L.

10183 **Markowitz, William.** The irregular variation in the speed of rotation of the Earth, *in* The Earth–Moon system—Internat. Conf., Goddard Space Flight Center, NASA, 1964, Proc.: New York, Plenum Press, p. 9–11, illus., 1966.

Determinations of irregular variations in rate of rotation of the Earth since 1956 show that the Earth was decelerating until about September 1957, accelerating until January 1962, and decelerating since. Data on rotation, represented by the sum of secular variation, irregular variation (parabolic segments), seasonal variation, and a small residual, support Brouwer's thesis that sudden, prolonged changes in speed do not occur, but sudden changes in acceleration do and are best represented by parabolic arcs. If changes are due to continuous effects which change suddenly, the irregular variation may be due to: "changes in moment of inertia caused by general change in dimensions or by continental uplift, changes in the magnetic coupling between crust and turbulent core, or interchange of momentum between the Earth's crust and the magnetic field in the solar system."—V.S.N.

00149 **Marsh, Owen T.** Evidence for deep salt deposits in western Florida Panhandle: Am. Assoc. Petroleum Geologists Bull., v. 51, no. 2, p. 212–222, illus., 1967.

Evidence for deep salt deposits are (1) trend of the Mississippi Salt Dome basin; (2) small round topographic highs on continental shelf; (3) two anticlinal structures on the continental shelf determined from seismic reflection measurements; (4) a domal structure broken by a northwest-trending graben; (5) contemporaneous faults of the Pollard graben which could have been caused by salt flowage; and (6) gravity minimum which may be caused by salt domes. Salt, if present, is probably at least 6,000 feet deeper than the present deepest holes.—W.C.C.

10289 **Martin, Richard A.** Eternal spring—Man's 10,000 years of history at Florida's Silver Springs: St. Petersburg, Fla., Great Outdoors Publishing Co., 264 p., illus., 1966.

This book is a revision of "A teacher's guide to Silver Springs", part of an educational kit presented in a five county test area; footnotes and work sections are placed at the end. The first two chapters review geological background and fossil finds. The earthquake of 1886 is described, along with the phenomena of smoke and flame over Wakulla swamp from gases escaping through fissures cut by underground rivers. A daily average of over half a billion gallons of water flows from Silver Springs, where the oldest exposed sediment in the state, the Ocala limestone of Eocene age, outcrops in a gentle dome. The subterranean water system of the vast Cenozoic limestone aquifer is described. The ancient basal rock formations are buried some 13,000 feet in Highlands County.—G.D.C.

10331 **Martinek, Johann; Thielman, Henry P.; Huebschman, Eugene C.** The effects of an oscillatory source in a spherical layer surrounding a liquid core: Seismol. Soc. America Bull., v. 56, no. 6, p. 1387–1412, illus., 1966.

For a model consisting of a single spherical elastic layer which surrounds a liquid core, we consider an SH source located inside the elastic layer, such that the field

created by the potential due to the source is axial symmetric and of steady state. The effect of gravity is neglected. The object of this study is to bring the solution into a form which permits ultimate computation of the effect of diffraction on the layer.—Authors' abstract

Marvin, T. C. *See* Marvin, Ursula B. 09992

09992 **Marvin, Ursula B.; Marvin, T. C.** A re-examination of the crater near Crestone, Colorado: Meteoritics, v. 3, no. 1, p. 1–10, illus., 1966.

The crater, an elliptical bowl measuring 355×246 feet with a mean depth of 23 feet, is in unconsolidated sand on an alluvial fan at the base of the Sangre de Cristo Range in the San Luis Valley. Airphotos show the crater as a striking feature on a gently undulating terrain. The crater and its vicinity were mapped at 2-ft contour intervals, and two lines of auger-hole samples were collected across it. Sand from the rim and floor is similar in grain size and composition to that of the surrounding area, and is barren of meteoritic debris, nickel-iron spherules, rock flour, and impact glass. The crater is less than half as deep relative to its diameter as known meteorite craters, and profiles indicate that the rim is a positive feature enclosing a basin whose floor is about level with the surface of the fan. It is concluded that this landform is not meteoritic or cometary in origin.—E.S.L.

10139 **Mason, Brian.** Principles of geochemistry (3d edition): New York, John Wiley and Sons, 329 p., illus., tables, 1966; originally published 1952.

This book was developed from a course of lectures designed for geology students and students in other sciences, especially chemistry. The aim is to synthesize significant facts and ideas on the chemistry of the Earth into a coherent account of the physical and chemical evolution of the Earth. Chapter headings are: the Earth in relation to the Universe, structure and composition of the Earth, some thermodynamics and crystal chemistry, magmatism and igneous rocks, sedimentation and sedimentary rocks, the hydrosphere, the atmosphere, the biosphere, metamorphism and metamorphic rocks, and the geochemical cycle. Appended are tables of atomic weights and atomic radii, the geological time scale, and estimated annual world consumption of the elements; and some questions and problems. A comprehensive index is included and selected references are given at the end of each chapter.—M.C.M.

00177 **Matten, Lawrence C.; Hopkins, William E.** *Hexapterospermum delevoryii* from the Middle Pennsylvanian of southern Illinois: Illinois Acad. Sci. Trans., v. 60, no. 1, p. 98–99, illus., 1967.

Several specimens of *Hexapterospermum delevoryii* Taylor, collected near Carrier Mills, Illinois are described. "Seeds" freed from the [coal-ball] matrix represent casts of the inner part of the integument and are illustrated.—Authors' abstract

Maurette, M. *See* Fleischer, R. L. 00114

Maurette, M. *See* Fleischer, R. L. 00115

Mayeda, Henry S. *See* Wilson, Robert R. 10301

10324 **Mayer, A.** La mécanique des roches [with English summ.], *in* Internat. Conf. Soil Mechanics and Found. Eng., 6th, Montreal, 1965, Proc., V. 3: Toronto, Ontario, Univ. Toronto Press, p. 105–113, illus., table, 1966.

Recent technical methods devised to determine mechanical properties of rocks are described for cases of dam foundations, underground projects, and slope stability. Laboratory tests are reviewed for measuring compressive strength and creep, hardness, permeability (especially changes with applied stresses), alterability, and the particular case of stratified materials. *In situ* tests are cited which should be made during reconnaissance of the site: geophysical tests and measurements of strains under stresses, of modulus of deformation at different depths, and of shear stress of stratified soils. How results of these tests should be used in the design is discussed, and methods of checking rock after construction are given.—G.D.C.

10174 **Mayo, Evans B.** Preliminary report on a structural study in the Museum Embayment, Tucson Mountains, Arizona: Arizona Geol. Soc. Digest, v. 8, p. 1–32, illus., 1966.

The structural geology of an area of the Museum Embayment, a large reentrant on the western side of the Tucson Mountains, was mapped. The structural features are thought to be the results of igneous action which was controlled by four "framework" directions. It is suggested that the structure of the Tucson Mountains is the result of dominantly vertical volcano-tectonics and attendant gravitational adjustments. The concept of a "compressive phase of the Laramide Orogeny" finds little support in the data mapped. More study of the Tucson Mountain Chaos and the Cat Mountain Rhyolite should give a better understanding of the origin of the Cat Mountain Rhyolite.—*from* Author's abstract

10235 **Mayuga, M. N.; Allen, D. R.** Long Beach subsidence, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 280–285, illus., 1966.

An elliptical bowl-shaped depression has developed along the Wilmington oil field axis; as the center settled, surface movements as high as 9 or 10 feet toward the center were recorded, and slippages occurring 1,550 to 1,750 feet below the surface caused small earthquakes. By 1951, the annual rate of subsidence was over two feet at the center, and total vertical movement has now reached 29 feet. A method of measuring compaction by comparisons of joint lengths between collars in the well casings is being used. Subsidence has now been stopped by repressuring with water injection wells, and the affected area reduced from 20 sq mi to 4.—E.S.L.

10055 **McCary, Charles E. L.** Mineral resources summary of the Petersburg quadrangle, Tennessee: Nashville, Tenn., Tennessee Div. Geology, 4 p., 1966.

This text accompanying Tennessee Div. Geology Geol. Map GM 72-SW by C. W. Wilson, Jr., and others (cited separately), describes the limestone and gravel resources in the Petersburg quadrangle. Of the five Ordovician limestone formations in the area, the Carters and Bigby–Cannon Limestones contain stone suitable for general or agricultural purposes; the others are generally unsatisfactory for quarry stone. Gravel has been mined intermittently for local use in the Cane Creek bed where bars range in thickness from 1 in to 6 feet locally. Although chert has not been mined, considerable quantities are present in the Fort Payne Formation.—M.C.M.

McCauley, John F. *See* Paradeses, William, 09952

10309 **McCauley, Marvin L.** Engineering geology related to highways and freeways, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 116–121, illus., 1966.

The role of the engineering geologist in planning, design, construction, and maintenance problems of highway engineering are discussed, especially as applied to California.—E.S.L.

McClain, W. C. *See* Bradshaw, R. L. 10192

00140 **McConnell, Harold; Chapman, Keith P.; Knox, James G.** A multivariate analysis of topographic slope in selected loess-mantled second order basins in Illinois [abs.]: Assoc. Am. Geographers Annals, v. 57, no. 1, p. 183, 1967.

McConnell, Robert K., Jr. *See* Allen, Ronald V. 10219

McCracken, R. J. *See* Daniels, R. B. 10168

McCrady, Allen D. *See* Guilday, John E. 10280

00113 **McDonald, Phillip M.** Disposition of soil moisture held in temporary storage in large pores: Soil Sci., v. 103, no. 2, p. 139–143, illus., tables, 1967.

Observed soil moisture profiles illustrate the contribution of depth of permeable surface materials to detention storage capacity and magnitude of subsurface flow. A soil moisture probe with a neutron source was used to quantitatively evaluate the lateral flow of subsurface water in detention storage. Percolation virtually ceased at that depth in the profile where the subsoil began (B_1 horizon). Just above this depth the downward-penetrating water became suspended and flowed laterally downslope.—J.W.H.

00284 **McFarlin, Peter F.** Aragonite vein fillings in marine manganese nodules: Jour. Sed. Petrology, v. 37, no. 1, p. 68–72, illus., tables, 1967.

Carbonate veins in marine manganese oxides from the Blake Plateau contain well-crystallized aragonite of inorganic origin in stellate groups and needles up to 3 mm long. Oxygen isotope analyses suggest that the aragonite formed at a temperature 4° to 6°C colder than present sediment temperature of 8° to 9°C.—*from* Author's abstract

McGreevy, Laurence J. *See* Welder, George E. 09977

McIntyre, D. B. *See* Baird, A. K. 00208

McKay, Edward J. *See* Colton, Roger B. 09968

10153 **McNeal, B. L.; Coleman, N. T.** Effect of solution composition on soil hydraulic conductivity: Soil Sci. Soc. America Proc., v. 30, no. 3, p. 308–312, illus., table, 1966.

Decreases in hydraulic conductivity with decreasing electrolyte concentration and increasing ratio of Na adsorption ratio of the percolating solution were assessed for seven soils of varying clay mineralogy. The decreases were particularly pronounced for soils high in 2:1 layer-silicates. No property of the solution alone was sufficient to characterize the response of the soils to a given solution, though expression of results in terms of the percentage of exchangeable Na of the soil and the salt concentration of the solution produced more nearly similar curves for soils of similar clay mineralogy. Relative magnitude and reversibility of the hydraulic conductivity decreases were strongly influenced by clay mineralogy.—*from* Authors' abstract

McQuade, J. F. *See* Dilcher, D. L. 00194

00286 **Meckel, L. D.** Tabular and trough cross-bedding—Comparison of dip azimuth variability: Jour. Sed. Petrology, v. 37, no. 1, p. 80–86, illus., table, 1967.

Local dip azimuth variability of tabular and trough types of crossbedding are documented and compared in two outcrops of Homewood Sandstone in Pennsylvania. Consistency ratio, standard deviation, and spread were found greater in trough crossbedding. Where readings along trough axes only were considered the scatter was comparable to that of tabular crossbedding foresets and the current direction was found uniform both stratigraphically and areally.—E.D.M.

00209 **Meckel, Lawrence D.** Origin of Pottsville Conglomerates (Pennsylvanian) in the central Appalachians: Geol. Soc. America Bull., v. 78, no. 2, p. 223–257, illus., tables, 1967.

An integrated stratigraphic, petrologic, and paleocurrent study was made of the Pottsville Formation and the Olean (Sharon) Conglomerate in order to reconstruct the conditions of deposition of these conglomerates and their associated sandstones. The depositional basin was an asymmetric, elongate, northeast-southwest-trending trough along whose tectonically active southeastern margin coalescing alluvial fans formed a wedge-shaped conglomerate (Pottsville) as much as 1,300 feet thick. Concurrently a 50-ft sheetlike conglomerate (Olean-Sharon) and its overlying sandstone were deposited by two contemporaneous south-flowing fluvial systems along the stable (cratonic) northern margin of the basin. By late Pottsville time north-directed deposition had spread across the trough area, and sandstones from the southern source were deposited on the stable platform.—H.C.W.

09996 **Mehl, Maurice G.** The Grundel mastodon: Missouri Div. Geol. Survey and Water Resources Rept. Inv. 35, 28 p., illus., 1966.

Scattered skeletal remains of an American mastodon, *Mammut americanus*, were excavated from Farmdale Loess [early Wisconsin Pleistocene] in a gravel pit located in Holt County, Mo., in 1963 under the author's direction. Radiocarbon dating of associated charcoal places the time of death at 25,100±2,200 years B.P. Contemporaneous human activity is postulated on the basis of skeletal positioning and green bone fracture of one tusk.—Author's abstract

10062 **Meiss, Donald P.** Paleozoic rocks in northwestern Pennsylvania and central New York. *in* Stratigraphic cross section of Paleozoic rocks—Colorado to New York: Am. Assoc. Petroleum Geologists Cross Sec. Pub. 4, p. 46–53, illus., 1966.

Cross section G–H, consisting of eight well logs, crosses a relatively stable shelf region of the Appalachian basin. Correlations are based primarily on lithology. No Permian beds are present, and everything above the Silurian is missing at the eastern end, and above the Mississippian in the west. Beds of metabentonite in the Black River Group represent volcanic activity in eastern Pennsylvania. During Cayugan time, a thick sequence of evaporites and dolomites accumulated in a highly saline basin.—E.S.L.

Melickian, Gary E. *See* Smoots, Vernon A. 10239

Melickian, Gary E. *See* Roberts, Don V. 10250

00126 **Menard, H. W.** Extension of northeastern Pacific fracture zones: Science, v. 155, no. 3758, p. 72–74, illus., 1967.

The great fracture zones of the northeastern Pacific extend into the central Pacific. At a relatively constant distance of 4,500 to 4,900 km west of the crest of the East Pacific Rise and of its projection through North America, the typically straight and simple fracture zones become more complex. However, the Clipperton fracture zone, including one branch, follows a great circle for almost 10,000 km, a quarter of the Earth's circumference.—Author's abstract

Messina, Angelina R. *See* Ellis, Brooks F. 00150

Messina, Angelina R. *See* Ellis, Brooks F. 10195

Metzer, C. F. *See* Gaudette, H. E. 10159

Metzger, William J. *See* Gilman, Richard A. 00287

Meyer, Gerald. *See* Davis, George H. 00171

00272 **Meyerhoff, A. A.** Opal, zeolites, and clays in an Eocene neritic sand bar [discussion of paper by E. G. Wermund and R. J. Moiola, 1966]: Jour. Sed. Petrology, v. 37, no. 1, p. 240, 1967.

This note reports an additional occurrence of zeolites in Gulf Coast Tertiary rocks, and thus modifies the statement by Wermund (ibid., v. 36, p. 248–253) that no heulandite or clinoptilolite have been recognized there.—H.A.T.

00295 **Middleton, G. V.** The orientation of concavo-convex particles deposited from experimental turbidity currents: Jour. Sed. Petrology, v. 37, no. 1, p. 229–239, illus., tables, 1967.

A substantial proportion (23–69 percent) of concavo-convex particles deposited from experimental turbidity currents assumed concave up or standing on end positions. The proportion was largest for the high concentration flows. Such orientations cannot be produced in sediments moved by traction (for example, deep ocean currents).—*from* Author's abstract

00264 **Miller, Fred Key.** Structure and petrology of the southern half of the Plomosa Mountains, Yuma County, Arizona [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2415B, 1967.

10271 **Miller, Halsey W.; Schwab, Karl W.** Microfossils from the Upper Cretaceous of Adobe Canyon, southern Arizona: Arizona Geol. Soc. Digest, v. 8, p. 65–95, illus., 1966.

Upper Cretaceous sediments from Adobe Canyon in the southeastern foothills of the Santa Rita Mountains contain a varied microfauna and microflora. The section consists of black to red shales, siltstones, and sandstones and was deposited in shallow fresh water ponds and streams. Invertebrate and charophyte remains indicate a non-marine environment. Micro-vertebrates include teeth of *Gyrodus?*, an amioid fish, and reworked ostracoderm plate fragments. Micro-invertebrates include mollusks, an ostracode, an unidentified mosquito, an insect claw, problematical amber spheres, hystrichomorphs, reworked chitinozoans, charophytes, palynomorphs, and remains of fungus. Evidence for Late Cretaceous erosion of lower Paleozoic rocks in southern Arizona is presented.—M.S.T.

10234 **Miller, R. E.** Land subsidence in southern California, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 272–279, illus., 1966.

The four major causes of subsidence are: tectonic activity, slower than the others; dewatering of sediments, mostly local; application of water to soils of low-moisture content, not a problem in this area; and pressure decline in artesian aquifers and oil and gas production zones, the most common cause in southern California. Antelope Valley and La Verne areas have subsided about two feet in the last 30 years due to lowering of the water level 150 feet. The Wilmington oil field has had the most spectacular subsidence, 28 feet by 1964; details are given on Long Beach subsidence. Consolidation tests on cores in advance of development will permit proper planning, and subsidence can be stopped by repressuring with injection wells.—E.S.L.

09987 **Millman, Peter M.** Craters: Meteoritics, v. 3, no. 2, p. 55–57, table, 1966.

Recent observational evidence emphasizes the importance of craters as a prominent surface characteristic of the smaller planetary bodies in the solar system. Craters of similar appearance may have very diverse origins. An initial assumption as to the type of origin should not influence an impartial and detailed physical study of any given crater.—Author's abstract

Mills, W. R. *See* Caldwell, R. L. 10123

Minch, John A. *See* Fife, Donald L. 00204

00236 **Mishu, Louis Petrous.** A study of stresses and strains in soil specimens in the triaxial test [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2345B–2346B, 1967.

09960 **Missaghi, Fazlollah.** Mercury content of stream sediments—A geochemical survey of the Magdalena mining district, New Mexico: New Mexico Bur. Mines and Mineral Resources Circ. 85, 26 p., illus., tables, 1966.

A geochemical survey was made of this mining district to establish the presence and extent of mercury anomalies in stream sediments. Bedrock and soil were sampled and analyzed for mercury dispersion, as well as for lead, zinc, molybdenum, and copper, to trace relations between anomalies of mercury and other metals. A geochemical bedrock traverse was made to establish the local threshold of lead, zinc, copper, molybdenum, and mercury in bedrock; necessary improvement was made in mercury detection equipment. In stream sediments, 76 percent of the mercury anomalies were confirmed by corresponding anomalies of all or three out of four other metals; in bedrock only 22 percent were thus confirmed.—M.S.T.

Missouri Div. Geol. Survey. *See* Koenig, John W. 10065

00147 **Moody, Clarence L.** Gulf of Mexico distributive province: Am. Assoc. Petroleum Geologists Bull., v. 51, no. 2, p. 179–199, illus., tables, 1967.

As defined, the distributive province of the Gulf of Mexico embraces substantial portions of the United States, Mexico, Guatemala, and Cuba. This 2,130,000 sq mi source area is drained by 100,000 mi of rivers activated by an average elevation of 2,535 feet. Yearly, some 260 cu mi of river water delivers 775 million tons of clay, silt, very fine sand, and 200 million tons of dissolved matter to the Gulf of Mexico, a 618,800 sq mi depositional area with 570,900 cu mi of water at a mean depth of 4,870 feet. Accentuated downwarping began in mid-Miocene time but shaping of the province is a post-glacial event. Topical discussions include surface waters, hypsometry, sedimentary filling provenance, alluvial deposits, eolian deposits, man—a geologic agent, sediment composition, and late Cenozoic history. This paper, published posthumously, is a culminating summary of years of geologic research.—B.H.K.

Moore, Carleton B. *See* Huss, Glenn I. 09989

Moore, Carleton B. *See* Huss, Glenn I. 09991

10237 **Moore, Return F.** Foundation engineering and the engineering geologist, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 327–343, illus., 1966.

One of the greatest contributions of engineering geology is to foundation engineering, information on gross structure of the site being obtained in the field, and physical properties of the material by testing. Geologic processes that can affect the structure are faults, accelerated weathering, and aggradation and degradation of stream channels. Dam and building foundations and site grading are reviewed, and the primary properties of soils, grain size, shape, mineral composition, specific gravity, porosity, and degree of saturation are discussed. Shear strength is related to moisture content and to type of testing. Unconfined compression, direct shear, and triaxial tests and consolidation and soil compaction tests are described. A section on foundation properties of geologic units in the greater Los Angeles area includes estuarine deposits, fine- and coarse-grained alluvium, preconsolidated sediments, and bedrock.—E.S.L.

Moore, Return F. *See* Marek, Charles E. 10303

10078 **Moorhouse, W. W.** Summation and appraisal [with French abs.], *in* Precambrian symposium—The relationship of mineralization to Precambrian stratigraphy in certain mining areas of Ontario and Quebec: Geol. Assoc. Canada Spec. Paper 3, p. 137–144, 1966.

In the summation a classification is suggested for the deposits described, according to the views of the authors of the various papers of the symposium. In the appraisal, criteria are suggested for testing the validity of theories of origin of ores, including: the principle of uniformitarianism; the significance of geometrical and structural associations of ores; the time relationships, i.e. the place of the ores in the geological development of the enclosing rocks; and the economy and precision of terminology used in describing the ores and their geology.—Author's abstract

Morgan, G. *See* Fleischer, R. L. 00115

00151 **Morris, William J.** Baja California—Late Cretaceous dinosaurs: Science, v. 155, no. 3769, p. 1539–1541, illus., 1967.

Late Cretaceous dinosaurs have been discovered along the Pacific margin of Baja California. The presence of *Hypacrosaurus* sp. is suggestive of correlation with the Upper Edmonton Formation, Alberta. Dissimilarities between the Baja California fauna and those from contemporary units along the eastern trend of the Rocky Mountains suggest that Baja California was ecologically separated from mainland Mexico during late Campanian and early Maastrictian time.—Author's abstract

Morrow, William E. *See* Wilson, Charles W., Jr. 10003

Mortland, M. M. *See* Ross, G. J. 10142

Mortland, M. M. *See* Raman, K. V. 10157

10257 **Mozola, Andrew J.** The water-table surface from hydrologic and topographic features—An exercise in environmental geology: Jour. Geol. Education, v. 14, no. 5, p. 187–190, illus., 1966.

A number of topographic quadrangles depicting poor drainage characteristics are suitable for developing an exercise on the contouring of the water table from surface hydrologic and topographic features. Since training should include both the appreciation of basic principles and the development of skills, this exercise provides the beginning student with the experience in (1) determining elevations from contour maps, and (2) the subsequent contouring of these points to reach an objective, namely the finished map. Thus the relationships between the water table surface and surface hydrologic features may be more fully understood and appreciated. At this point the instructor can devise a number of problem situations in environmental geology as a further expansion of the exercise.—Author's abstract

00183 **Mudge, Melville R.** Surficial geologic map of the Sawtooth Ridge quadrangle, Teton and Lewis and Clark Counties, Montana: U.S. Geol. Survey Geol. Quad. Map GQ-610, scale 1:24,000, 1967.

10216 **Muir, W. G.; Cochrane, T. S.** Rock mechanics investigations in a Canadian salt mine [with French and German abs.], *in* Internat. Soc. Rock Mechanics Congress, 1st, Lisbon, 1966, Proc., V. 2: Lisbon, Portugal, Laboratório Nacional Engenharia Civil, p. 411–416, illus., 1966.

The rock mechanics program at the Domtar Chemical Ltd. mine at Goderich, Ontario, was designed to determine the uniformity of the salt bed, particularly the immediate roof, and to measure the time-dependent deformations in large mine openings. Numerous laboratory compression, Brazilian, and flexure tests and underground deformation measurements were made. Laboratory results on underground block samples are tabulated. Underground convergence measurements in a room exposed three years before instrumentation show that convergence at each station increases at a constant rate with time: $Y = 0.0015t + 0.107$, where Y is deformation in inches and t is time in days. However, at a site exposed for 153 days before instrumentation vertical and horizontal deformation rates decreased with time; these results can be expressed by logarithmic equations.—V.S.N.

Multer, H. G. *See* Hoffmeister, J. E. 00197

Munizaga, F. *See* Hart, S. R. 00158

10291 **Munk, Walter H.** Variation of the Earth's rotation in historical time, *in* The Earth-Moon system—Internat. Conf., Goddard Space Flight Center, NASA, 1964, Proc.: New York, Plenum Press, p. 52–69, illus., table, 1966.

Techniques of calculation and calculations of variations in the rate of rotation of the Earth are considered based on data of observed and calculated discrepancies in calculated longitudes of the Moon and the Sun recorded since about 1680. Fractional variation due to tidal torques responsible for acceleration of the Moon, deceleration by solar tides, and slight acceleration by solar atmospheric tides are examined. It is estimated that 2/3 of the total dissipation of tidal energy in the Earth-Moon system is attributable to shallow seas. Extrapolation into the geologic past shows that if tidal friction is largely associated with shallow seas, extrapolation for even 10,000 years is hazardous, and the residual term can be extrapolated only if it is due to growth of the core.—V.S.N.

10036 **Munoz, James Loomis.** Synthesis and stability of lepidolites [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1988B, 1966.

00141 **Murphy, Richard E.** A spatial classification of landforms based on both genetic and empirical factors—A revision [abs.]: Assoc. Am. Geographers Annals, v. 57, no. 1, p. 185, 1967.

00281 **Murray, R. C.; Lucia, F. J.** Cause and control of dolomite distribution by rock selectivity: Geol. Soc. America Bull., v. 78, no. 1, p. 21–35, illus., 1967.

The Turner Valley Formation of Moose Mountain, Alberta, exhibits both horizontal and vertical irregularity of diagenetic dolomitization. The distribution pattern of the dolomite is a function of the availability of dolomitizing water and the distribution of the more easily dolomitized lime mud in respect to the less susceptible crinoidal sands. The mud–sand distribution is, in turn, believed to be a function of tidal channel currents, with the lime muds deposited in interchannel areas and the sands in the channels.—R.G.Y.

00128 **Nace, Raymond L.** Are we running out of water?: U.S. Geol. Survey Circ. 536, 7 p., illus., table, 1967.

It is time to stem waste of water and destructive exploitation of the environment. Most of the world's water is oceanic brine, most land water is frozen in Antarctica and Greenland, and only a small part of continental water is available for use and management. Discharge of rivers to sea is a close measure of availability of liquid water, but ground-water reservoirs have important functions as inexpensive equalizers of supply. The function of soil moisture, a major factor in water economy, is usually overlooked in assessments of use and future demand. The principal use of water in advanced countries is as a waste disposal medium. Despite regional maldistribution, given rational management, U.S. water supplies are adequate. Water pollution is primarily a problem of economics, not of health. A paramount problem in most of the world is shortage of water development and management facilities.—*from* Author's abstract

10135 **Nawar, F. G.; Liang, W. L.; Clay, C. S.** A pulse-compression echo sounder for ocean bottom surveys: Jour. Geophys. Research, v. 71, no. 22, p. 5279–5282, illus., 1966.

A pulse-compression echo sounder (PCES) that has been developed and used in two ocean bottom surveys is described. The system provides a fine resolution of closely spaced bottom and subbottom surfaces in the deep ocean, improved signal-to-noise ratio over conventional echo sounders, subbottom penetration up to 30 m, and qualitative indication of bottom surface roughness. Typical sections of the data are given.—D.B.V.

Neill, Charles R. *See* Chitale, Shrikrishna V. 00303

Nettleton, W. D. *See* Daniels, R. B. 10168

10014 **Nettleton, Wiley Dennis.** Pedogenesis of certain Aquulitic and Aquic Normudultic soils of the North Carolina Coastal Plain [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1674B, 1966.

10129 **Newton, Robert C.** BeO in pegmatitic cordierite: Mineralog. Mag., v. 35, no. 275, p. 920–927, 1966.

Several cordierites from pegmatites were found to contain as much as 0.7 wt. percent of BeO. Structural crystallographic considerations suggest that the beryl molecule ($Be_3Al_2Si_6O_{18}$) may have appreciable solubility in the cordierite structure. It is probable that most cordierites from pegmatites will be rich in BeO. If it can be established that the cordierite–beryl join is binary, possibly cordierite could be used as a geothermometer for pegmatites. The amount of BeO in the cordierite would indicate a minimum crystallization temperature for the pegmatite.—E.E.A.

09988 **Nininger, H. H.; Huss, Glenn I.** Free copper in the Odessa, Texas, siderite: Meteoritics, v. 3, no. 2, p. 71–72, illus., 1966.

The Odessa siderite is the third nickel-iron meteorite in which free copper has been found. The copper grain, 0.3×0.4 mm, was found within schreibersite around a troilite nodule, as were the earlier discoveries.—E.S.L.

Nishi, Charles K. *See* Prokopovich, Nikola P. 00288

Northrop, Stuart A. *See* File, Lucien. 09974

00237 **Nowatzki, Edward Alexander.** Fabric changes accompanying shear strains in a cohesive soil [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2347B, 1967.

Nowlin, J. O. *See* Giroux, P. R. 10104

10281 **Nowroozi, Ali A.** Terrestrial spectroscopy following the Rat Island earthquake: Seismol. Soc. America Bull., v. 56, no. 6, p. 1269–1288, illus., tables, 1966.

Measurements of the eigenperiods of the Earth from strain recordings after the Rat Island (Alaska) earthquake of February 4, 1965, are presented. Novelties of these measurements include the separation of the torsional strain field from the spheroidal strain field and an attempt to measure the azimuthal order number m for each modal order l. The observed periods are compared to theoretical periods of four Earth models. Landisman's M1 and Dorman's R1 models gave best agreement with observations of the fundamental modes, whereas the Jeffreys–Bullen B model agreed better with observations of the overtones; the fourth was a Gutenberg–Bullen A model.—D.B.V.

10148 **Nuffield, E. W.; Harris, D. C.** Studies of mineral sulpho-salts—[Pt.] 20, Berryite, a new species: Canadian Mineralogist, v. 8, pt. 4, p. 407–413, illus., tables, 1966.

Berryite, named in honor of Professor L. G. Berry, occurs as lath-like bluish-grey crystals, monoclinic, with a 12.72, b 4.02 (axis of elongation), c 58.07A, β 102.5°. The probable cell contents are 6 [Pb_2 (Cu,Ag)$_3$ Bi_5S_{11}]. The calculated density of 7.11 g/cm^3 compares with a measured value of 6.7. X-ray diffraction powder data are given.—J.R.C.

O'Brien, John L. *See* Allen, Ronald V. 10219

Okamura, Arnold I. *See* Koyanagi, Robert Y. 10095

10197 **O'Keefe, John A.** The origin of tektites: Space Sci. Rev., v. 6, no. 2, p. 174–221, illus., 1966.

Evidence for the origin of tektites is reviewed by a discussion of terrestrial and lunar hypotheses in relation to chemical composition, geographic distribution, age data, and, in the case of lunar origin, the mechanism of arrival through the atmosphere. The hypothesis of extraterrestrial origin has received support in recent years through application of aerodynamics, study of the Muong Nong tektites (apparently representing parent material from which other types are derived), and study of the Ranger pictures of the Moon. A lunar origin is considered most likely, and implies that large portions of the lunar surface are covered with ash-flow tuff of a type remarkably free of water and other volatiles, and that the Moon was derived from the Earth after formation of the Earth's core.—V.S.N.

Oliver, William A., Jr. *See* Simmons, George C. 00220

00265 **Osborne, Robert Howard.** Bedrock geology and limestone petrology of eastern Hamilton County, Ohio [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2415B–2416B, 1967.

10127 **Östrem, Gunnar.** The height of the glaciation limit in southern British Columbia and Alberta: Geog. Annaler, ser. A, v. 48A, no. 3, p. 126–138, illus., 1966.

Methods for determining the climatic snowline are briefly described. The firn line on glaciers will normally lie slightly lower than the climatic snowline. From a study

of the distribution of glaciers and the altitudes of surrounding mountains, it is possible to determine a critical height which has to be exceeded if glaciers should form. This is about 100 m above the snowline. The glaciation limit was determined on a large number of topographic maps, the results plotted on a small-scale map, and contour lines drawn showing its regional variation. Possible errors in the determinations are discussed. A comparison is made with different maps showing precipitation, continentality, land surface elevation, and the 1961 firn line altitude on glaciers. It is concluded that the height of the glaciation limit is inversely connected with precipitation distribution.—*from* Author's abstract

09969 **Outerbridge, William F.** Geologic map of the Oil Springs quadrangle, eastern Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-586, scale 1:24,000, section, text, 1966.

Oil, gas, coal, limestone, sandstone, asphaltic sandstone, and shale and clay are the principal mineral resources of the Oil Springs quadrangle. Oil has been produced from the Mississippian "Weir" sand, and gas from the same source and other formations; both oil and gas reserves are nearing depletion. Several coal beds have been mined sporadically. Mississippian Greenbrier and Newman Limestones contain much oil and limestone is quarried mainly for road metal. Sandstone suitable for dimension stone is abundant at the top of the Lee Formation; locally it is saturated with oil to a thickness of as much as 15 feet. Shale suitable for many purposes is found below the Lee Formation and in the Breathitt Formation. Clay occurs below a coal bed near the top of the Lee and in the Haddix-Hazard coal zone.—M.C.M.

00203 **Palmquist, John C.** Structural analysis of the Horn area, Bighorn Mountains, Wyoming: Geol. Soc. America Bull., v. 78, no. 2, p. 283-298, illus., geol. map, 1967.

Block-like uplift of Precambrian metamorphic rocks during Laramide deformation resulted in the formation of an asymmetric faulted mountain mass extending south from the central Bighorn unit. In the metamorphic rocks, the distribution of mapped units and the geometry of the foliation define a major complex anticline that plunges moderately to the north-northwest. Lineation and the axes of minor folds are subparallel to the axis of the major anticline, as defined by beta-diagrams. The faulted block is bounded on the west by the Horn fault and on the north by the Tensleep fault. The Tensleep fault is a rejuvenated, cross-cutting, Precambrian fault, whereas the Horn fault parallels the foliation of the Precambrian rocks. The structure of overlying sedimentary strata resulted from draping over active basement blocks.—R.A.L.

09952 **Paradeses, William; McCauley, John F.; Colquhoun, Donald J.** The geology of the Blythewood quadrangle: South Carolina Div. Geology Map Ser. MS-13, scale 1:24,000, text, 1966.

About three-fourths of the Blythewood quadrangle is underlain by Coastal Plain sediments and the remainder by low rank metamorphic rocks of the Paleozoic Carolina Slate Group. The latter consists of a thick geosynclinal accumulation of volcanic flows, tuffs, tuffites, and fine grained sedimentary rocks of the graywacke type; three distinct lithologic units have been recognized: mafic and felsic tuffite, and bedded argillite. Several Triassic diabase dikes were mapped. Coastal plain sediments consist of the Late Cretaceous Middendorf Formation, and colluvium. Materials of potential value in the Carolina Slate Group are saprolites, argillites, diabase, quartz; the Middendorf Formation has numerous lenses of relatively pure, massive white kaolin; and the uppermost sands are used for several purposes.—M.C.M.

00276 **Parsons, Willard H.** Irazú Volcano: Cranbrook Inst. Sci. News Letter, v. 36, no. 6, p. 70-76, illus., 1967.

Irazú, 11,262 feet above sea level, is a composite volcano in Costa Rica with base diameter about 15 mi. The mile-wide summit area consists of overlapping craters; the outer and largest crater floor forms a wide terrace around the southern margin of the recently active crater, now over 1,000 feet deep and about a half mile in

diameter. The recent eruption began with a violent explosion March 13, 1963 and lasted through January 1965, reaching its climax in the winter of 1964. Samples of fresh ash and glassy bombs show the material to be basaltic andesite with approximately 55 percent SiO_2, typical of older material. San José had a costly problem of removing tons of dust and fine ash. Ash on slopes of mountains represents a continuing danger of landslides and mudflows in rainy seasons; its effect on agriculture, a more immediate disaster, will result in fertile soil of the future.—M.C.M.

00277 **Patchen, D. G.** Developing suitable X-ray radiography techniques for thin rock slabs: Jour. Sed. Petrology, v. 37, no. 1, p. 225–227, tables, 1967.

X-ray radiography of rock slabs is simplified if all slabs are cut to uniform thickness of about 3 mm. High-contrast slow speed films with minimum grain are usually best for fine-grained materials and, once chosen, control exposure time and development processes. Thus, the remaining variable is kilovoltage, which is varied according to specimen densities.—H.A.T.

00213 **Patterson, Sam H.** Bauxite reserves and potential aluminum resources of the world: U.S. Geol. Survey Bull. 1228, 176 p., illus., tables, 1967.

Some bauxites consist chiefly of gibbsite, others of boehmite, and some are mixtures. Largest bauxite deposits are in Australia and Guinea, with reserves of 2 and 1.2 billion tons and potential resources of 1 and 2.4 billion tons, respectively. Jamaica has about 600 million tons reserves. Countries having 200–300 million tons reserves include Ghana, Yugoslavia, Surinam, and the U.S.S.R., and possibly India and Brazil; those having 50–150 million tons reserves include Hungary, Nyasaland, Greece, France, British Guiana, French Guiana, and the Dominican Republic-Haiti. The United States has about 45 million tons reserves and 300 million tons potential resources. Potential sources of aluminum other than bauxite are discussed also.—S.H.P.

Pavlides, Louis. *See* Kane, M. F. 10108

Peck, John H. *See* Schilling, Frederick A., Jr. 00172

Perkins, Robert L. *See* Wells, Dana. 00308

10037 **Perry, Kenneth, Jr.** High grade regional metamorphism of Precambrian gneisses and associated rocks, Paradise Basin quadrangle, Wind River Mountains, Wyoming [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1989B, 1966.

09979 **Peter, George.** Magnetic anomalies and fracture pattern in the northeast Pacific Ocean: Jour. Geophys. Research, v. 71, no. 22, p. 5365–5374, illus., table, 1966.

A group of magnetic anomaly bands (parallel to each other and striking 163°) near the western boundary of the north-south magnetic lineations have been traced across the major fracture zones of the northeast Pacific from the Aleutian trench to the latitude of Hawaii. Together with bathymetric data these anomalies reveal a new fracture 400 km north of the Mendocino fracture zone, the Surveyor fracture zone, along which there has been 1,305 km of right-lateral strike-slip motion. The trend of the magnetic anomalies; bathymetry, and fracture pattern of the crust in the crest of the East Pacific rise are significantly different from those observed in the central northeast Pacific.—D.B.V.

10258 **Peters, William C.** The role of the geologist in the life cycle of a mine: Jour. Geol. Education, v. 14, no. 5, p. 191–193, illus., 1966.

A mining geologist must have an appreciation for the objectives of the particular enterprise. A background in engineering and economics for such an appreciation is commonly developed on a long term basis during a geologist's career; a preliminary framework can, however, be provided at an earlier stage in the classroom through several lectures on the life cycle of selected mining operations. The role of the geologist can be related to the initial stage, youth, maturity, old age, and abandonment of representative mineral-based enterprises. The geologist's

effectiveness throughout the cycle can be stressed as depending upon his depth of understanding in relating his science to each important management decision.—Author's abstract

10255 **Peterson, Donald W.** The geology of Picketpost Mountain, northeast Pinal County, Arizona: Arizona Geol. Soc. Digest, v. 8, p. 159–176, illus., table, 1966.

Picketpost Mountain, four miles southwest of Superior, Pinal County, is a nearly circular, butte-shaped mountain, capped by porphyritic quartz latite entirely unrelated to the dacitic ash-flow sheet which covers much of the surrounding area. The quartz latite is a lava flow extending from a vent that occupies a good part of the northwestern flank of the mountain, and is distinctly younger than the dacite. The other volcanic rocks composing the mountain are described briefly.—M.S.T.

10067 **Peterson, Earl T.** Paleozoic rocks in southeastern Colorado, *in* Stratigraphic cross section of Paleozoic rocks—Colorado to New York: Am. Assoc. Petroleum Geologists Cross Sec. Pub. 4, p. 1–5, illus., 1966.

Location of cross section A–B was governed by well control, and is based on eight logs. All systems, except the Silurian and possibly the Devonian, are represented. The Hugoton embayment, Las Animas arch, Sierra Grande–Apishapa uplift, and Front Range–Wet Mountains uplift influenced deposition.—E.S.L.

00298 **Peterson, Gary L.** Implications of two Cretaceous mass transport deposits, Sacramento Valley, California—Reply to comment by Brown and Rich [1967]: Jour. Sed. Petrology, v. 37, no. 1, p. 248–257, illus., 1967.

The objections of Brown and Rich (ibid., p. 240–247) to the hypothesis of a disconformity between the Cretaceous Antelope Shale and Venado Formation are rejected for lack of evidence. Itemized objections are answered as follows: (1) contact relations are both conformable and disconformable in different areas; (2) mapped intertonguing is in fact the result of mapping the same lithology in different lithosomes of the same formation; (3) parallelism of formations over wide areas does not preclude a time break between them; (4) a small break in fossil succession exists and becomes more significant eastward. The evidence of erosion at the discussed contact recognized by Brown, Rich, and this author is strong enough to suggest a break in sediment deposition and probably a significant time gap.—R.A.C.

Petrafeso, F. A. *See* Balsley, J. R. 00279

09947 **Philbin, P. W.; Smith, C. W.** Aeromagnetic map of the Manchester quadrangle, Hartford and Tolland Counties, Connecticut: U.S. Geol. Survey Geophys. Inv. Map GP-596, scale 1:24,000, 1966.

Philpotts, John A. *See* Schnetzler, C. C. 00222

09959 **Phinney, Robert A.; Alexander, Shelton S.** P-wave diffraction theory and structure of the core-mantle boundary: Jour. Geophys. Research, v. 71, no. 24, p. 5959–5975, illus., tables, 1966.

The theory for diffraction of elastic waves in a spherical geometry is reviewed and modified to apply to a multilayer geometry. We have made numerical calculations of the attenuation function for P-waves in the shadow of the core for certain basic geometries and for models which have a single layer at the core-mantle boundary. Resonance phenomena due to the presence of the layer are discussed, and an attempt is made to explain observed peaks in the attenuation spectrum for various regions of the core boundary. A region between 30 and 160 km thick, with a reduced shear velocity and an increased density, appears to be the most likely explanation of the data.—Authors' abstract

Phinney, Robert A. *See* Alexander, Shelton S. 09961

Pilkey, Orrin H. *See* Harriss, Robert C. 09983

10170 **Plafker, George; Kachadoorian, Reuben.** Geologic effects of the March 1964 earthquake and associated seismic sea waves on Kodiak and nearby islands, Alaska: U.S. Geol. Survey Prof. Paper 543–D, p. D1–D46, illus., tables, 1966.

The areal distribution of aftershocks, local tectonic deformation, and estimated source area of the tsunami of the Alaskan earthquake of March 28, 1964 (Gmt) all suggest that the Kodiak group of islands lay immediately adjacent to and northwest of the focal region. Intensity and felt duration of the main shock and aftershocks varied and were influenced by the local geologic environment. Effects included numerous landslides; local subsidence; temporary and permanent changes of level in wells, lakes, and streams; vertical displacements both downward and upward depending upon relation to the axis of tectonic tilting; and at least 7 seismic sea waves. The combination of effects caused the loss of 18 lives, 45 million dollars in property damage, and 5 million dollars damage to the fishing industry.—V.S.N.

Plouff, Donald. *See* Joesting, H. R. 10002

10098 **Plouff, Donald.** Magnetotelluric soundings in the southwestern United States: Geophysics, v. 31, no. 6, p. 1145–1152, illus., table, 1966.

Twelve magnetotelluric soundings were made along a 460-mile traverse in the southwestern United States. Spectral analysis of digitized graphic records was used to determine apparent resistivities and phase differences for periods in the range 10–1,000 sec. The geoelectric section to depths of the order of 300 km was found to be divided into three principal layers. The layer nearest the surface has a resistivity of 200 ohm-m or less. The next layer, which begins in Paleozoic carbonate rock or near the top of the Precambrian rocks, has a resistivity of 500 ohm-m or more. The resistivity of the lowest layer is in the range 5–100 ohm-m and the depth to the top is in the range 20–150 km.—D.B.V.

10112 **Podolsky, George.** An evaluation of an airborne electromagnetic anomaly in northwestern Quebec, *in* Mining geophysics—V. 1, Case histories: Tulsa, Okla., Soc. Explor. Geophysicists, p. 197–205, illus., 1966.

A factor often overlooked in the interpretation of electromagnetic anomalies is the effect of magnetic permeability on electromagnetic response. Magnetic effects can be evaluated by empirical methods. Ground surveys may also be used for this purpose, but though they provide more detailed coverage of the anomaly, the readings are not continuous and, for most ground EM units, the coil spacing is too large for proper resolution of the EM response. A discussion of ground and airborne data is presented along with the geologic picture and drill results from a conductor in northwestern Quebec. The discrepancies between the interpreted and actual results may be attributed largely to the effects of a narrow zone of high permeability.—*from* Author's abstract

Pollack, H. N. *See* Briggs, L. I. 00117

10326 **Pomeroy, Harry F., Jr.** A model to demonstrate limestone cavern formation: Jour. Geol. Education, v. 14, no. 5, p. 207, illus., 1966.

Construction of a model to show the effects of solution of limestone by ground water is described, using sugar cubes cemented together for limestone. Block of cubes should be tight against one of the glass sides of a box, covered with fine sand, and enough water added to cover cubes and sand. Usually caves form within 30–45 minutes, and caverns within 90; in four to six hours collapse structures appear. Blocks can be removed and allowed to dry for three-dimensional study.—E.S.L.

10332 **Power, Dean V.** A survey of complaints of seismic-related damage to surface structures following the Salmon underground nuclear detonation: Seismol. Soc. America Bull., v. 56, no. 6, p. 1413–1428, illus., 1966.

Numerous unexpected complaints of damage were received from residents living 15–40 km away from the Salmon nuclear experiment in Mississippi. Ground motion at these ranges was within the predicted safe limits. It is shown that the damage threshold of 5 cm per sec surface particle velocity is not descriptive of this area,

and revised damage criteria need to be formulated that take into consideration geology, frequency spectrum, and other factors in addition to surface particle velocity. The triggering of naturally occurring settlement cracks is suspected, but the physics of the process is not yet fully understood.—D.B.V.

10296 **Prescott, Glenn C., Jr.** Surficial geology and availability of ground water in part of the lower Penobscot River basin, Maine: U.S. Geol. Survey Hydrol. Inv. Atlas HA–225, scale 1:62,500, separate text, 1966.

The lower Penobscot River basin of this report covers about 825 sq mi in east-central Maine. Largest supplies of ground water occur in Pleistocene and Recent unconsolidated deposits. Ground and surface water are closely related and any change in regimen of one will affect the other. Bedrock formations, dense and containing little water compared to their volume, generally contain recoverable water only in secondary openings. Outcrop areas of unconsolidated deposits are shown on the geologic map and their character and water-bearing properties are described in the table of geologic units. Principal chemical constituents of ground water are shown in graphic form, and their sources, recommended limits, significance, and occurrence are given in a table. In general the quality of ground water is good for most purposes.—M.C.M.

10079 **Preston, Robert E.** Turtles of the Gilliland faunule from the Pleistocene of Knox County, Texas: Michigan Acad. Sci., Arts and Letters Papers 1965, v. 51, p. 221–239, illus., tables, 1966.

The Gilliland turtle faunule was collected from the three lower beds of the Seymour Formation along the South Wichita River. Systematic descriptions of specimens from the families Trionychidae and Testudinidae are given, and the associated forms, climate, and habitat discussed.—E.S.L.

Price, P. B. *See* Fleischer, R. L. 00114

Price, P. B. *See* Fleischer, R. L. 00115

10126 **Price, Robert J.** Eskers near the Casement Glacier, Alaska: Geog. Annaler, ser. A, v. 48A, no. 3, p. 111–125, illus., 1966.

A series of eskers and esker systems in front of the Casement Glacier, Alaska, were examined in the field in 1962. The same eskers were mapped by photogrammetric methods from aerial photography taken in 1948 and 1963. Comparisons between the two maps indicate that some of the eskers originated as deposits of englacial or supraglacial streams and were subsequently let down on to the subglacial floor.—Author's abstract

Proctor, Richard. *See* Lung, Richard. 10282

10302 **Proctor, Richard J.** The Colorado River Aqueduct, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 72–80, illus., 1966.

The Colorado River Aqueduct extends from Lake Havasu on the Colorado River, 244 mi to the terminal reservoir, Lake Mathews, near Riverside, Calif.; of this distance 92 mi are tunnels. A summary is given of the construction history of four dams and eight reservoirs.—E.S.L.

00288 **Prokopovich, Nikola P.; Nishi, Charles K.** Methodology of mechanical analysis of subaqueous sediments: Jour. Sed. Petrology, v. 37, no. 1, p. 96–101, illus., 1967.

Textural analysis of present-day sediments composed of clams, animal and plant remains, and mineral grains and aggregates from the Delta-Mendota Canal, San Joaquin Valley, California, yields greatly different results for different analytical methods. Volumetrically, and in its natural wet state, the organic fraction constitutes 90 percent of the sediment. By dry weight, the organic fraction constitutes only 10 percent of the sediment. Analysis by dry sieving and weighing of fractions may misrepresent the texture and composition of these sediments.—R.A.C.

10203 **Pye, Willard D.** Arizona—A new frontier to explore: Interstate Oil Compact Comm. Comm. Bull., v. 8, no. 2, p. 37–49, illus., 1966.

Arizona produces oil, gas and helium, and although about 550 wells have been drilled, most have been shallow and test only surficial horizons to depths of 1,000–2,000 feet; the balance of the stratigraphic section has scarcely been tested. Most wells are in Apache, Navajo, Cochise, and Coconino Counties; many tests were drilled for other purposes, although helium possibilities were checked; some were not located on a geological basis for oil or gas discovery. A large portion of the State is underlain by a marine Paleozoic section with a generally non-marine section above except in northwestern and locally in northeastern and southeastern Arizona. Folds, faults, unconformities, facies changes, and reef structures are all present in the stratigraphically favorable northeastern, southeastern, and northwestern parts of the State. The southwestern area needs further work to evaluate its potential.—*from* Author's abstract

Ragsdale, James A. *See* Shirley, Martha Lou. 10069

10071 **Rainwater, E. H.** The geological importance of deltas, *in* Deltas in their geologic framework: Houston, Tex., Houston Geol. Soc., p. 1–15, illus., 1966.

Most of the land-derived sediment of the geologic past was deposited in coastal environments, much of it in deltas. Rapid burial of organic matter took place, and from it much of the world's fossil fuel was formed. Study of modern delta formation and distribution of sediments in them will aid in finding ancient deltas and understanding the stratigraphic traps that may be present. Vertical and horizontal sequence of sediments in deltas are described. In addition to these, the geometry, fauna, land-plant distribution, alternations of shallow marine and transitional sediments, and diapiric structures are criteria which can be used to identify ancient deltaic deposits.—E.S.L.

10222 **Rajasekaran, K. C.** Narsarsukite from Mont St. Hilaire, Quebec, Canada: Canadian Mineralogist, v. 8, pt. 4, p. 506–514, illus., tables, 1966.

The occurrence of narsarsukite in association with neptunite in the hornfels collar around the alkaline igneous pluton of Mont St. Hilaire, Quebec, is reported. The optical, chemical and X-ray data for narsarsukite are presented and compared with those available in the literature. The relationship between ferric iron and epsilon and between titania and birefringence are traced in this paper. It is concluded that sodium and titanium metasomatism is responsible for the formation of narsarsukite.—Author's abstract

10157 **Raman, K. V.; Mortland, M. M.** External specific surface area of vermiculite: Am. Mineralogist, v. 51, nos. 11–12, p. 1787–1792, illus., table, 1966.

The external specific surface area of a number of carefully fractionated size ranges of natural vermiculite from several different sources and of kaolinite, muscovite and biotite was determined using a nitrogen absorption technique. Although reasonable agreement between calculated and measured values for kaolinite and for the fine size fractions of the micas was found, for vermiculite the measured external surface values were higher than the calculated ones, and were nearly twice the surface area of micas in corresponding size ranges. The effect of saturation with calcium, magnesium, lithium, or sodium was negligible, but saturation by potassium or ammonia gas decreased the surface area.—*from* Authors' summary

Reimnitz, Erk. *See* VonHuene, Roland. 00198

Renton, John J. *See* Wells, Dana. 00308

10206 **Reyes, Salvador F.; Deere, Don U.** Elastic-plastic analysis of underground openings by the finite element method [with French and German abs.], *in* Internat. Soc. Rock Mechanics Cong., 1st, Lisbon, 1966, Proc., V. 2: Lisbon, Portugal, Laboratório Nacional Engenharia Civil, p. 477–483, illus., 1966.

A method of analyzing stress concentrations and displacements around cavities of arbitrary shape was developed, wherein the plasticity of the material was assumed to be governed by parameters analogous to angle of internal friction and cohesion. The yield function plots as a cone in principal stress space; the stress–strain relations were obtained by regarding the function as a plastic potential. The displacement method of finite element analysis was employed in a step by step application of load. At each step, increments of displacement which satisfy equilibrium were determined by a recursive process. Stress concentrations around circular openings in an infinite medium were analyzed for arbitrary values of yield parameters and initial state of stress. Results reflect effects of volumetric expansion accompanying yielding.—*from* Authors' abstract

Rich, Ernest I. *See* Brown, Robert D., Jr. 00297

10173 **Risley, Clifford, Jr.; Abbott, William L.** Radioactivity in Lake Erie and its tributaries, *in* Great Lakes Research, 9th Conf., Chicago, 1966, Proc.: Michigan Univ. Great Lakes Research Div. Pub. 15, p. 416–422, illus., tables, 1966.

Gross alpha and beta radioactivity levels of water, bottom sediment, and plankton samples in Lake Erie and tributary mouths were studied by the U.S. Public Health Service from 1963 to 1965. Values for dissolved solids and bottom sediment beta activities in the lake were generally quite low with ranges less than 1 to 39 picocuries per liter and 11 to 81 picocuries per gram, respectively. Plankton beta activity results ranged from 33 to 1200 picocuries per gram, indicating the ability of these organisms to concentrate radionuclides. Tributary alpha and beta values were low with slightly higher activities during the spring season, which may only reflect increased precipitation and runoff. Lake Michigan average radioactivity results differed little from Lake Erie values; but individual activities exhibited greater ranges, and higher results tended to cluster around the northern part, especially in Green Bay.—*from* Authors' abstract

00266 **Roadifer, Jack Ellsworth.** Stratigraphy of the Petrified Forest National Park, Arizona [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2416B, 1967.

09957 **Robert, M. F.** Géomorphologie et évolution du littoral du Pacifique au sud d'Acapulco [also English and Spanish texts]: Photo Interpretation 66-4, p. 1–21, illus., 1966.

Three sets of stereoscopic triplets with interpretive overlays are given for the coastal area south of Acapulco, Guerrero, Mexico. A tombola has formed at the northern end of the area, covered by a mangrove swamp, and is contemporaneous with the first of two raised strandlines. Three series of dunes occur farther south, the moving dunes overrunning the fixed. In the central part a narrow beach is in front of the strandlines, which are not easily separated here, but an older one with a different morphology is recognized. The older dunes disappear here. To the south, the mouth of the Río Papagayo has been displaced southeastward by sand, and old courses can be traced on the photographs. The strandlines have been cut by the river and more material deposited, making them very difficult to interpret.—E.S.L.

10250 **Roberts, Don V.; Melickian, Gary E.** Geologic and other natural hazards in desert areas, *in* Seminar on "The importance of the earth sciences to the public works and building official," Anaheim, Calif., 1966: Glendale, Calif., Assoc. Eng. Geologists, Los Angeles Sec., p. 315–350, illus., 1966.

Various geologic and other environmental conditions affect the safe and economical use of desert regions by exploding population. This paper summarizes problems related to flooding and deposition of alluvial soils, gullying and erosion, collapsing soils, expansive soils, caliche and hardpan, playas and desert lakes, windblown soils, water development, faulting and crustal movements, and damage to agricultural land from accumulation of evaporated chemicals. It is believed that problems in the development of desert regions differ from those usually encountered in more humid regions. In planning desert communities there must be an awareness of the total environment and the impact produced by man on his surroundings.—G.D.C.

10077 **Robertson, J. A.** The relationship of mineralization to stratigraphy in the Blind River area, Ontario [with French abs.]. *in* Precambrian symposium—The relationship of mineralization to Precambrian stratigraphy in certain mining areas of Ontario and Quebec: Geol. Assoc. Canada Spec. Paper 3, p. 121–136, illus., table, 1966.

The Archean rocks are Keewatin-type greenstones intruded by Algoman granites, dated at about 2,500 m.y., and consisting of gneissic granodiorites and massive quartz monzonite. This complex was eroded to a peneplain and the lower Huronian Bruce Group deposited on it. The upper Huronian Gowganda and Lorrain Formations unconformably overlie these. Dikes and sills of Nipissing diabase are dated at 2,130 , the Cutler granite at 1,750 (Penokean orogeny), and the Keweenawan diabase dikes at 1,100 m.y. Copper mineralization is associated with the Nipissing diabase. Uranium ores in basal conglomerates of the Lower Mississagi Formation, are considered to be modified placers. Uranium production from Blind River was over 944 million dollars to the end of 1962.—E.S.L.

09982 **Robinson, Peter.** Paleontology and geology of the Badwater Creek area, central Wyoming—Pt. 3, Late Eocene Apatemyidae (Mammalia; Insectivora) from the Badwater area: Carnegie Mus. Annals, v. 38, art 15, p. 317–320, illus., table, 1966.

Apatemys hendryi, n. sp., and the considerably larger *Apatemys* sp. cf. *A. bellus* are described from isolated lower molars from the late Eocene Hendry Ranch Member of the Tepee Trail Formation, in localities 5-front and 5A, between Badwater Creek and Cedar Ridge fault. Six specimens of *A. hendryi*, including the type, are from locality 5A; this species is absent from locality 5-front. Both species are also present in collections from the middle Eocene Green River Formation in northeastern Utah. Measurements of 10 molars, representing both species, are tabulated.—V.M.J.

Rogers, M. A. *See* Swain, F. M. 00273

10136 **Roller, J. C.; Jackson, W. H.** Seismic wave propagation in the upper mantle—Lake Superior, Wisconsin, to central Arizona: Jour. Geophys. Research, v. 71, no. 24, p. 5933–5941, illus., table, 1966.

Seismic-refraction measurements indicate that P-waves travel with an apparent velocity of about 8.5 kmps at depths greater than about 100 km, at least from central Nebraska to south-central Arizona. The attenuation of P-waves propagating in the upper mantle is extremely low in the Central Lowlands and the Great Plains. The data do not indicate the existence of a "shadow zone" attributable to a Gutenberg low-velocity zone for P-waves in the upper mantle.—Authors' abstract

00267 **Root, Forrest Keith.** Structure, petrology, and mineralogy of pre-Beltian metamorphic rocks of the Pony-Sappington area, Madison County, Montana [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2416B, 1967.

10142 **Ross, G. J.; Mortland, M. M.** A soil beidellite: Soil Sci. Soc. America Proc., v. 30, no. 3, p. 337–343, illus., tables, 1966.

X-ray diffraction analysis of the $<2\,\mu$ fraction of the main horizons of a podzol soil from northern Michigan shows that montmorillonite is the dominant layer silicate in the A2 horizon. This montmorillonite appears to have weathered from illite and mica, and chlorite interstratified with vermiculite and montmorillonite, which are present in the underlying horizons. The montmorillonite in the $<0.2\,\mu$ fraction of the A2 horizon contains some randomly interstratified mica. The expanding component of this fine fraction is a beidellite with exchange capacity $\gamma = 0.49\text{M}^{+}$ per half unit cell, and having a high layer charge, most of which arises from tetrahedral substitution, and shows a strong tendency to fix K.—*from* Authors' abstract

10214 **Rouse, George C.; Wallace, George B.** Rock stability measurements for underground openings [with French and German abs.]. *in* Internat. Soc. Rock Mechanics Congress, 1st, Lisbon, 1966, Proc., V. 2: Lisbon, Portugal, Laboratório Nacional Engenharia Civil, p. 335–340, illus., 1966.

In the excavation for the Morrow Point underground power plant, on the Gunnison River in southwestern Colorado, measurements were made for a wall convergence, absolute and relative deformations of the roof arch, and rock bolt loads. Instrumentation, installation, and methods of measurement are described. It was found that rock movements were produced by movement of the mass adjacent to the excavation rather than by local movements of rock in the roof or sides. During periods of intensive blasting, a marked increase in rock movements and rock-bolt loads was noted on the left wall of the excavation.—V.S.N.

10175 **Runcorn, S. K.** Change in the moment of inertia of the Earth as a result of a growing core, *in* The Earth-Moon system—Internat. Conf., Goddard Space Flight Center, NASA, 1964, Proc.: New York, Plenum Press, p. 82–92, illus., 1966.

The continuing growth of the core can explain changes in the mantle convection pattern; these changes are essential to explain recent occurrence of continental drift. A simple model for growth of the core by convection is to assume that the amount of iron entering the core is proportional to its surface area and to the amount remaining in the mantle. Once the growth rate is known, the change of moment of inertia of the Earth with time can be calculated. From the relation of moment of inertia to radius of the core and radius of the core to age of the Earth, it is possible to obtain the variation of length of day with age. If the core grows slowly, there will be a gradual decrease of moment of inertia which will introduce an angular acceleration counter to but less than angular deceleration due to tidal interaction of the Moon. Paleontological methods to determine length of day are considered also.—V.S.N.

00255 **Russell, Edgar Ernest.** Measurement of the optical constants of sapphire and quartz in the far infrared with the asymmetric Fourier transform method [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2491B–2492B, 1967.

10004 **Russell, Ernest E.** Geologic map of the Sardis quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 12–NE, scale 1:24,000, separate text, 1966.

The accompanying text, "Mineral resources summary of the Sardis quadrangle, Tennessee," by R. E. Hershey, 1966, is cited separately.—M.C.M.

10005 **Russell, Ernest E.** Geologic map of the Purdy quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 4–NE, scale 1:24,000, separate text, 1966.

The text accompanying this map, "Mineral resources of the Purdy quadrangle, Tennessee," by L. T. Larson, 1966, is cited separately.—M.C.M.

10105 **Russell, Loris S.** Dinosaur hunting in western Canada: Toronto Univ. Royal Ontario Mus. Life Sci. Contr. 70, 37 p., illus., 1966.

A review of the geologic history of the Canadian Prairies (Alberta and Saskatchewan) since mid-Cretaceous times is given as background for stories of the exploratory expeditions for dinosaur remains. These are divided into the early expeditions, 1873–1901, the Golden Age, 1910–1917, and the continuing search. Biographical material on the geologists, and notes on the history of the Geological Survey of Canada, are combined with descriptions of the dinosaurs found.—E.S.L.

00268 **Sable, Edward George.** Geology of the Romanzof Mountains, Brooks Range, northeastern Alaska [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2417B, 1967.

10113 **Salt, D. J.** Tests of drill hole methods of geophysical prospecting on the property of Lake Dufault Mines Limited, Dufresnoy Township, Quebec, *in* Mining geophysics—V. 1, Case histories: Tulsa, Okla., Soc. Explor. Geophysicists, p. 206–226, illus., tables, 1966.

The new Lake Dufault massive sulfide ore body, which was discovered by diamond drilling in 1961, lies at depths of between 1,000 and 1,400 feet below the surface. It provides a good measuring rod for testing the techniques of drill-hole geophysics. During 1962 a series of tests was carried out, using several geophysical methods.

Results show that any one of these methods would have detected the presence of the ore body, from a drill hole within 125 feet of its margin. None of the methods is foolproof. The most difficult problem is to determine the direction of the ore body with respect to the hole surveyed. Also, as indicated by follow-up surveys, conductors of unknown substance may produce anomalies comparable to those resulting from a million ton body of massive sulfides.—Author's abstract

09998 **Salthe, Stanley N.; Kaplan, Nathan O.** Immunology and rates of enzyme evolution in the Amphibia in relation to the origins of certain taxa: Evolution, v. 20, no. 4, p. 603–616, illus., 1966.

The micro-complement fixation method of quantitative immunology technique is applied to enzyme evolution in the Amphibia, with emphasis on origin of salamanders (Urodela). Using the hypothesis that average overall rate of evolution in any given enzyme will be constant in the phyletic lines carrying it, and extrapolating structures of lactate dehydrogenases of modern amphibians backward in time to convergence, it is concluded that: salamanders and frogs diverged sometime in the Permian; salamanders underwent major radiation between early Triassic and middle Jurassic; amphiumids and plethodontoids diverged from other salamanders in the Triassic, and from each other in the Cretaceous; and rhacophorids diverged from ranids in the Cretaceous. Interpretation of data will rest or fall on the basis of future fossil finds.—V.M.J.

10106 **Scharbert, H. G.** Alkali feldspars from microsyenitic dikes of southern Greenland: Mineralog. Mag., v. 35, no. 275, p. 903–919, 1966.

Photographs of b-axis oscillation show that alkali feldspar crystals are restricted in composition ($Or_{42.4}$–$Or_{35.3}$) but are rich in Ca (up to An_{14}). Variation of 2V from 45°–71° puts the crystals between the sanidine-anorthoclase cryptoperthite and orthoclase microperthite classes. Since the syenitic magma cooled rapidly, some peculiarities in structural state of the alkali feldspars are expected; the K-rich phase is nearly monoclinic. According to the reciprocal lattice angles α^* and γ^* the Na-rich phase can be divided into 3 groups: high temperature pericline twinned and high temperature albite twinned phases, high temperature pericline twinned and low temperature albite twinned, and high temperature pericline twinned and low temperature albite twinned phases with nearly identical values of the reciprocal lattice angle γ^*.—E.E.A.

10184 **Schatzman, E.** Interplanetary torques, *in* The Earth-Moon system—Internat. Conf., Goddard Space Flight Center, NASA, 1964, Proc.: New York, Plenum Press, p. 12–25, illus., 1966.

The relation of continuous variation, long-term variation, and sudden variations in rotation of the Earth to solar activity is examined, and it is concluded "that interplanetary torques, whether due to the Earth's magnetic field or to solar corpuscular radiation, are too small to cause large changes in the length of day. On the other hand, solar phenomena probably influence the large-scale circulation of the atmosphere, and the problem of the continuous and sudden variations in length of day is one of meteorological phenomena induced by solar activity."—V.S.N.

00172 **Schilling, Frederick A., Jr.; Peck, John H.** Geologic map of the Orangeburg quadrangle, northeastern Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-588, scale 1:24,000, section, text, 1967.

Argillaceous limestone suitable for the manufacture of portland cement occurs in the upper 25 feet of the Grant Lake Limestone in the Orangeburg quadrangle. Limestone gravel with a silty matrix is dug annually from channels of larger streams, crushed, and used to surface local roads. A show of gas was reported at a depth of 294 feet, apparently in the Kope Formation. Granite was encountered at a depth of about 3,300 feet. Lake sediments along Cabin Creek are easily eroded and, when wet, flow and slump on steep slopes. Areas underlain by the Preachersville Member of the Drakes Formation and the Crab Orchard Formation are best locations for farm ponds. Numerous springs are present along the base of the Brassfield

Formation. A diagrammatic cross section of Wisconsin sediments in Cabin Creek valley shows facies relations at time of maximum valley fill.—M.C.M.

10270 **Schleh, E. E.** Stratigraphic section of Toroweap and Kaibab Formations in Parashant Canyon, Arizona: Arizona Geol. Soc. Digest, v. 8, p. 57–64, 1966.

Four complete sections of the Kaibab and Toroweap Formations have been measured and described from northern Parashant Canyon in the southern Shivwits Plateau, west of the Grand Canyon, to clarify some of the regional stratigraphic relations in this part of Arizona and adjacent areas. With minor exceptions, all four sections are identical, so that they are presented as a single composite section to give a more accurate portrayal of the Toroweap and Kaibab Formations in this area.—M.S.T.

00283 **Schmalz, Robert F.** Kinetics and diagenesis of carbonate sediments: Jour. Sed. Petrology, v. 37, no. 1, p. 60–67, illus., table, 1967.

A simplified kinetic model of carbonate sediment diagenesis is compatible with the results of laboratory investigations of reactions between both sea water and distilled water and mixed carbonate assemblages. The consequences of the steady-state model are in close agreement with field observations in carbonate environments and afford a possible explanation of the supersaturation of tropical marine surface waters, selective solution of metastable mineral phases and the mineralogic differences between modern carbonate sediments and ancient limestones. Slow evolution of carbon dioxide from aqueous solution is an important factor in diagenesis of carbonate sediments.—*from* Author's abstract

10273 **Schmitt, Harrison A.** The search for ore deposits: Arizona Geol. Soc. Digest, v. 8, p. 125–130, 1966.

A review is given of the history of development of mineral exploration techniques, the changing relationship of geologists to mining engineers and geophysicists, and a summary of problems and needs in exploring and developing new mineral deposits.—M.S.T.

00222 **Schnetzler, C. C.; Thomas, H. H.; Philpotts, John A.** The determination of barium in G-1 and W-1 by isotope dilution: Geochim. et Cosmochim. Acta, v. 31, no. 1, p. 95–96, 1967.

Barium determinations obtained for the rock standards G-1 and W-1 by isotope dilution are reported. The results suggest that barium concentration is $1,040 \pm 20$ ppm in G-1 and 158 ± 2 ppm in W-1. Sample inhomogeneity in G-1, however, may be quite important, and the value obtained here might represent only the concentration in the sample analyzed.—D.B.V.

00214 **Schnitzer, M.; Hoffman, I.** Thermogravimetric analysis of the salts and metal complexes of a soil fulvic acid: Geochim. et Cosmochim. Acta, v. 31, no. 1, p. 7–15, illus., tables, 1967.

Salts and complexes of 16 different mono-, di-, and trivalent metal ions with a podzol fulvic acid, a water-soluble soil humic compound, were prepared; each was characterized by chemical and infrared methods and, in more detail, by thermogravimetry. The results show that (1) thermal stabilities of combinations formed by a soil humic compound with metal ions depend on the nature of the cation and (2) the thermal stabilities of complexes formed between fulvic acid and divalent metal ions appear to be inversely related to their stability constants.—D.B.V.

10100 **Schrott, Robert Otto.** Paleoecology and stratigraphy of the Lecompton megacyclothem (Late Pennsylvanian) in the northern Midcontinent region [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1989B–1990B, 1966.

00269 **Schultz, Gerald Edward.** The geology and paleontology of a late Pleistocene basin in southwest Kansas [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2417B–2418B, 1967.

Schwab, Karl W. *See* Miller, Halsey W. 10271

Schwarz, E. J. *See* Kobayashi, Kazuo. 10007

Sclar, C. B. *See* Stephenson, D. A. 10198

00121 **Scott, Robert W.** San Juan basin's oil promising south flank merits a close look: Oil and Gas Jour., v. 65, no. 10, p. 140–142, illus., 1967.

The Cretaceous and Pennsylvanian rocks on the south flank of the San Juan basin in northwestern New Mexico present relatively undrilled petroleum potential. The Pennsylvanian rocks include a high energy carbonate facies that is favorable for biostrome development, sand pinchouts, and truncation traps. This facies, is bordered on one side by a continental rock and on the other side by deeper water marine rocks. Cretaceous rocks contain discontinuous sandstone bodies that are also potential reservoir rocks.—K.A.D.

10038 **Seddon, George.** Middle Paleozoic conodonts from the Llano uplift, Central Texas [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1990B, 1966.

00196 **Serafim, J. Laginha; delCampo, Alejandro.** Interstitial pressures on rock foundations of dams—Closure [to discussions of papper 4484, 1965]: Am. Soc. Civil Engineers Proc., v. 93, Jour. Soil Mechanics and Found. Div., no. SM 1, p. 122–124, 1967.

The interstitial pressure in the bedrock beneath a dam is a function of the temperature of the rock and of the pore fluids. The opening of joints is dependent on temperature according to the following relationship: $\Delta e = \alpha d \Delta T$, where Δe is the change in the width of the opening, d is the average distance between joints, ΔT is the change in temperature, and α is the coefficient of linear expansion of the rock.—J.W.C.

10260 **Sexton, J. K.** Modern Canadian dams [with French summ.], *in* Internat. Conf. Soil Mechanics and Found. Eng., 6th, Montreal, 1965, Proc., V. 3: Toronto, Ontario, Univ. Toronto Press, p. 168–184, illus., table, 1966.

The characteristic features of the major physiographic regions of Canada are discussed to illustrate the problems involved in locating dam sites. In the older Appalachians of eastern Canada where low relief and broad valleys are characteristic, it is possible to build relatively low dams; whereas in the Cordillera where young ranges are separated by deep, backfilled linear valleys and in the permafrost region of northern Canada each site proposes a different problem. Examples of dam sites given include the zoned earthfill Portage Mtn. Dam where the Peace River escapes eastward from the Rocky Mtn. Trench; the South Saskatchewan Dam site where the underlying Bearpaw shale is in a state of elastic rebound; the concrete Manicouagan 5 Dam on the Canadian Shield, the largest multiple-arch structure in the world; and the rock-filled Mactaquac Dam in the Appalachians.—G.D.C.

00170 **Shacklette, Hansford T.** Copper mosses as indicators of metal concentrations: U.S. Geol. Survey Bull. 1198-G, p. G1–G18, illus., tables, 1967.

Chemical analyses of the element content of the mosses *Mielichhoferia macrocarpa* and *Platydictya jungermannioides* and their substrates collected from a volcanic rock area of Amchitka Island, Alaska, suggest that the former plant is a copper moss and a local indicator of mineral enrichment and that the latter has considerable tolerance to metals but is not useful as an indicator in mineral prospecting. It could not be established that *M. macrocarpa* requires certain concentrations of metals in the substrate to determine its distribution. Analyses of *M. mielichhoferi* suggest that this plant is also an indicator of metal concentrations; its known range is in eastern North America which complements the western and northern distribution of *M. macrocarpa*. Reference is made to the European species of *Mielichhoferi* and other useful mosses in North America.—V.S.N.

10061 **Shearrow, George G.** Paleozoic rocks in Ohio, *in* Stratigraphic cross section of Paleozoic rocks—Colorado to New York: Am. Assoc. Petroleum Geologists Cross Sec. Pub. 4, p. 41–45, illus., 1966.

Cross section F–G extends basinward (eastward) from western Ohio. The seven well logs used are correlated mainly on insoluble residues. The Waverly arch influenced Cambrian–Ordovician deposition, and the Cincinnati arch the Late Ordovician. The Devonian contains several unconformities, and outcropping rocks are not representative of the subsurface. No systems above the Mississippian are present.—E.S.L.

Sheffey, Nola B. *See* Zubovic, Peter. 00215

10069 **Shirley, Martha Lou; Ragsdale, James A.** (editors). Deltas in their geologic framework: Houston, Tex., Houston Geol. Soc., 251 p., illus., tables, 1966.

Of the eleven papers in the volume, eight are cited separately. An appendix presents maps, on the same scale, of 24 of the more important modern deltas of the world to demonstrate variations in size and shape. A second volume will be published containing a compilation of published data on all modern deltas, with an annotated bibliography.—E.S.L.

Shor, George G., Jr. *See* VonHuene, Roland. 00198

00270 **Sides, James Wesley.** The geology of the Central Butte Mountains, White Pine County, Nevada [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2418B, 1967.

10039 **Silver, Burr Arthur.** North American mid–Jurassic through mid–Cretaceous stratigraphic patterns of Colorado Plateau, Rocky Mountains, and Great Plains [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1990B–1991B, 1966.

00220 **Simmons, George C.; Oliver, William A., Jr.** Otter Creek coral bed and its fauna, east–central Kentucky: U.S. Geol. Survey Bull. 1244–F, p. F1–F13, illus., tables, 1967.

The Otter Creek coral bed is a limestone of Late Ordovician (Richmondian) age on the east flank of the Cincinnati arch in Kentucky. Where present, it is considered the basal unit of the Preachersville Member of the Drakes Formation. The most abundant fossils are the corals *Calapoecia huronensis, Foerstephyllum vacuum, Grewingkia rustica, and Tetradium approximatum*. The stromatoporoid *Aulacera cylindrica* and brachiopods of the genera *Hebertella and Platystrophia* are also common. Upper Ordovician coral beds containing similar faunas occur on the west side of the Cincinnati arch, but their relation to the Otter Creek coral bed is uncertain. Systematic annotations of the corals and stromatoporoids in the Otter Creek are included.—G.C.S.

10337 **Simmons, H. B.** Field experience in estuaries, [Chap.] 16 *in* Estuary and coastline hydrodynamics: New York, McGraw–Hill Book Co. (Eng. Soc. Mons.), p. 673–690, illus., 1966.

Neglecting effects of freshwater inflow and density difference, the magnitudes and duration of tidal currents in estuaries are a function of the tidal range at the entrance, characteristics of the ocean tide at the entrance, and physical characteristics of estuary channels. The amount of fresh water received and degree to which it mixes with salt water in the estuary are important to the vertical circulation pattern. The harbors of Savannah, Ga., Charleston, S. C., and Hudson River, N. Y., are examples of differing flow predominance and sedimentation.—G.D.C.

10254 **Simmons, Hilah L.** The geology of the Cabeza Prieta Game Range: Arizona Geol. Soc. Digest, v. 8, p. 147–157, illus., 1966.

The Cabeza Prieta Game Range is of geologic and physiographic interest as a representative part of the Sonoran Region of the Basin and Range Province. Located in southern Yuma and Pima Counties, Arizona, the area remains a relatively

undisturbed desert wilderness. The area encompasses nearly 1,400 sq mi of low, generally northwest-trending mountain ranges separated by wide alluvial valleys, with elevations varying from 600 to 3,323 feet above sea level. The mountains are of two types: sierra type mountains composed of metamorphic or granitic rocks and mesa type mountains composed primarily of volcanics. Several ranges are skirted by pediments. The valleys are drained by ephemeral streams which finally drain into the Gulf of California, with the exception of two areas which drain into enclosed playas.—Author's abstract

10040 **Simms, Frederick Eugene, Jr.** The igneous petrology, geochemistry, and structural geology of part of the northern Crazy Mountains, Montana [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1991B, 1966.

00154 **Sims, P. K.; Zietz, Isidore.** Aeromagnetic and inferred Precambrian paleogeologic map of east-central Minnesota and part of Wisconsin: U.S. Geol. Survey Geophys. Inv. Map GP-563, scale 1:250,000, section, separate text, 1967.

The dominant feature of east-central Minnesota is the Keweenawan basin containing a thick succession of mafic lavas and sandstones and shales. Magnetic anomalies and trends for the most part correlate with observed geology. The western part of the area, underlain by pre-Keweenawan rocks, is characterized by small irregular magnetic anomalies, whereas the eastern part, underlain by Keweenawan rocks, is characterized mainly by linear anomalies. Magnetic data contribute to economic geology, particularly near St. Cloud where supplementary work is needed for tracing rock units suitable for commercial use, near Hutchinson for possible magnetic schist or iron formation, at Lake Washington for iron formation, in the Twin Cities area for ground-water information, and in eastern Minnesota for possible native copper.—M.C.M.

Singh, Madan M. *See* Wang, Yih-Jian, 10215

10118 **Sinkankas, John.** Mineralogy—A first course: Princeton, N. J., D. Van Nostrand Co., 587 p., illus., tables, 1966.

Chapter headings in part 1 (mineralogy) are: introduction, atoms and minerals, classification of minerals, crystal growth, geometry of crystals, physical properties, specific gravity, optical properties, formation and association of minerals, and identification procedures and tests. Part 2 (descriptive mineralogy) covers native elements, sulfides, sulfosalts, oxides and hydroxides, halides, carbonates, borates, sulfates, chromates, phosphates, arsenates, vanadates, tungstates, molybdates, and silicates. Appendixes contain identification tables and selected references and reading material. In the index boldface entries indicate principal minerals and boldface page references where these minerals are described.—M.C.M.

Skinner, E. L. *See* Giroux, P. R. 10104

10041 **Sliter, William Volk.** Upper Cretaceous Foraminifera from southern California and northwestern Baja California, Mexico [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1991B, 1966.

09981 **Sloan, Robert E.** Paleontology and geology of the Badwater Creek area, central Wyoming—Pt. 2, The Badwater multituberculate: Carnegie Mus. Annals, v. 38, art. 14, p. 309-315, illus., table, 1966.

The ectypodontid multituberculate mammal *Parectypodus lovei*, n. sp., is described from 22 specimens of isolated molars and fragmentary lower premolars, from the late Eocene Hendry Ranch Member of the Tepee Trail Formation, in localities 5 and 5A between Badwater Creek and Cedar Ridge fault, Natrona County, Wyo. Tooth measurements and cusp formulas of this species correspond rather closely to those of *Parectypodus* species from the early Eocene Four Mile fauna of Colorado (McKenna, 1960). Before this discovery, the Multituberculata were thought to have become extinct in early Eocene time.—V.M.J.

10236 **Slosson, James E.** Engineering geology in the marine environment, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 305–317, illus., 1966.

Along the southern California coastline there are 50 miles of rocky beaches, 80 miles that are sandy backed by lowlands, and 173 miles are sandy backed by cliffs. Most of the beaches receive prime nourishment from the adjacent sea floor, in material transported offshore by streams; many are retreating due to drought and stream reclamation projects cutting down the available supply of sand. The effects of tides, waves, currents, and tsunamis are considered also. Geologists are interested in the continental shelf because of petroleum possibilities, and manganese nodules. Reclamation of tidal flats and the development of islands also offer engineering challenges. Several possibilities for future projects are suggested.—E.S.L.

Smith, C. W. *See* Balsley, J. R. 00185

Smith, C. W. *See* Philbin, P. W. 09947

10149 **Smith, F. G.** Computation and plotting of liquidus isotherms in multicomponent silicate systems: Canadian Mineralogist, v. 8, pt. 4, p. 424–430, illus., 1966.

Machine plotting of computed two-dimensional projections of isotherms on liquidus boundaries in multicomponent silicate systems has been coded in FORTRAN for an IBM 7094 computer and a CALCOMP digital plotter. Specimen results, using data of a twelve-component rock system (average granite plus water), are presented.—Author's abstract

10081 **Smith, H. Roger.** Solution features of the Traverse Limestone in Michigan: Michigan Acad. Sci., Arts and Letters Papers 1965, v. 51, p. 375–387, illus., 1966.

The karst regions of Michigan were glaciated at least four times, so the topography has been modified by glacial erosion and subsequent drift deposits. Aerial photographs of the northern part of the Lower Peninsula were studied and solution features identified and checked in the field. These features tend to occur in the Upper and Middle Traverse limestones. A drift thickness map has demonstrated that where drift is under 20 feet thick, bedrock formations have a strong influence on surface morphology. Evidence indicates that many of the solution features are preglacial. The features filled by drift may have been reestablished during ice retreat, by the large volumes of meltwater, and new subterranean features formed. Postglacial sinks are often located within preglacial features. In areas of thicker drift only the postglacial features can be distinguished.—E.S.L.

Smith, J. V. *See* Stephenson, D. A. 10198

10252 **Smith, Jay L.** Geology of nuclear plant sites, *in* Seminar on "The importance of the earth sciences to the public works and building official," Anaheim, Calif., 1966: Glendale, Calif., Assoc. Eng. Geologists, Los Angeles Sec., p. 366–386, 1966.

Public confidence in the adequacy and safety of nuclear installations is undermined by ignorance and fear of both geologic phenomena and nuclear energy. The California coastline is fraught with problems such as erosion, landsliding, earthquakes, and seismic sea waves. Geologic criteria for nuclear sites, as generally applied to most large engineering works, deal with foundation adequacy, vertical and lateral stability, and flood protection. Earthquakes and faults are very critical to nuclear site evaluation and have been subjects of great controversy. Hazards cannot be eliminated, but risks can be minimized through geologic, seismologic, and engineering investigations, diligent review procedures of the AEC, and research into geologic phenomena.—G.D.C.

Smith, Jay L. *See* Albee, Arden L. 10335

10274 **Smith, Russell.** Geology of the Cerro Colorado Mountains, Pima County, Arizona: Arizona Geol. Soc. Digest, v. 8, p. 131–145, illus., geol. map, 1966.

The Cerro Colorado Mts., 45 mi. southwest of Tucson, Ariz., comprise a three-fold sequence of Late Mesozoic(?) to Quaternary lava flows and tuffaceous deposits in a variety of stratigraphic and structural relationships. Lavas of intermediate to basic composition flowed from local vents over gently arched Cretaceous(?) sedimentary rocks. Water laid tuffs overlie the flows from which they were derived. Pumice, tuff, and rhyolite were then emitted to form a complex sequence with various degrees of welding. Erosion and redeposition filled depressions and mantled marginal slopes with tuffaceous conglomerate. Basalt flows cap the eastern half of the range marking the final igneous activity. At least one local vent is identified for each eruptive cycle. Block faulting led to stripping of basalt followed by gravity sliding of tuffaceous rocks down the northwest flank.—*from* Author'a abstract

Smith, T. J. *See* Hart, S. R. 00131

Smith, T. J. *See* Steinhart, J. S. 00133

10103 **Smith, Terrence J.** Engineering geology on new second lock, St. Marys Falls canal, Sault Ste. Marie, Michigan [abs.], *in* Inst. Lake Superior Geology, 12th Ann., 1966: Sault Ste. Marie, Mich., Michigan Technol. Univ., p. 23, 1966.

10248 **Smith, Travis W.** Repair of landslides, *in* Seminar on "The importance of the earth sciences to the public works and building official," Anaheim, Calif., 1966: Glendale, Calif., Assoc. Eng. Geologists, Los Angeles Sec., p. 204–245, illus., 1966.

The repair of landslides in California, by use of excavation, drainage, restraining structures and other methods is described and illustrated. Adequate investigation to determine causes and contributing elements of the slide is stressed. Natural and man-made landslides are described, as well as such repair techniques as slope flattening, surface and subsurface drainage blankets, stabilization trenches, horizontal drains, tunnels, and relief wells. The possible use of restraining structures such as buttresses, and retaining walls is discussed. Miscellaneous methods by use of dowels, tie rods or rock bolting, grouting and electro-osmosis are mentioned. Some situations require construction in a slide area, assuming risks and future repairs in lieu of the more expensive correction of an existing slide.—*from* Author's abstract

Smith, W. Everett. *See* Clarke, O. M., Jr. 09970

Smith, W. Everett. *See* Clarke, O. M., Jr. 09971

Smith, W. Everett. *See* Clarke, O. M., Jr. 09973

10239 **Smoots, Vernon A.; Melickian, Gary E.** Los Angeles Dodgers' Stadium—Effect of geological factors on design and construction, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 364–369, illus., 1966.

The Dodgers' Stadium is located in a rugged, hilly area with deep narrow valleys. Studies in which site geology played a major role were made prior to and during construction to predict stability of cut and fill slopes, settlement characteristics and lateral stability of foundations on rock slopes. The site is underlain by the Puente Formation whose steeply dipping sandstone and shale beds are fractured at intervals; several faults are present, but none is active. Compacted fill was used in the valleys. Performance of the stadium has been good.—E.S.L.

Snetsinger, K. G. *See* Keil, Klaus. 00116

10154 **Snetsinger, Kenneth G.** Barium-vanadium muscovite and vanadium tourmaline from Mariposa County, California: Am. Mineralogist, v. 51, nos. 11–12, p. 1623–1639, illus., tables, 1966.

Barium-vanadium muscovite and zoned vanadium tourmaline occur in quartz graphite schist in northwestern Bass Lake quadrangle, Mariposa County, Calif. Barium has substituted for potassium in the large cation formula group of the muscovite, and the positive charge thus induced has required excess substitution of tetrahedral aluminum for silicon to maintain electrical neutrality of the mineral.

Physical properties are similar to those of chromium muscovite. The inner zone of the tourmaline contains trivalent vanadium as well as divalent cations commonly present in schorl or dravite, substitution of oxygen for hydroxl and fluorine has taken place to compensate for the excess positive charge. Similar substitution has occurred in the outer zone of the tourmaline. It is suggested that the metals present in these minerals were primary constituents concentrated with organic material in the original sediment.—*from* Author's abstract

10042 **Snider, Henry Irwin.** Stratigraphy and associated tectonics of the Upper Permian Castile–Salado–Rustler evaporite complex, Delaware basin, west Texas and southeast New Mexico [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1992B, 1966.

00111 **Soderstrom, Glen S.** Central Texas' Llano area may prove to be prime prospect for nation's future oil-shale production: Oil and Gas Jour., v. 65, no. 13, p. 148–149, illus., 1967.

Oil shale, perhaps more prolific and of higher quality than any yet discovered on the North American continent, crops out in the Llano area of central Texas. Yields from retorts at 750°F ranged up to 42.2 gal/ton. The petroliferous character of the Mississippian Barnett Shale has long been recognized. The Barnett onlaps a karst topographic surface on the Ellenburger and as a result many sinkholes are filled with the shale, although locally the Chappel Limestone is found at the base. The Barnett is overlain unconformably by the Pennsylvanian Marble Falls Limestone. The shale is found in a four-county area and ranges to more than 40 feet in thickness.—K.A.D.

00145 **Soister, Paul E.** Geologic map of the Coyote Springs quadrangle, Fremont County, Wyoming: U.S. Geol. Survey Misc. Geol. Inv. Map I-481, scale 1:24,000, section, text, 1967.

All known uranium minerals in the Coyote Springs quadrangle are in the Wind River Formation in a basin area where buried ridges of the Cloverly, Morrison(?), and Mowry Formations lie to the north, and the Wind River pinches out to the south on the flank of the Sweetwater uplift. The extent of a thick carbonaceous shale zone about 290–485 feet below the surface over an area of 1 sq mi or more at and west and north of two mines is not known. The Wind River is the most favorable unit in which to search for other uranium deposits. However, anomalous radioactivity and anomalous amounts of uranium in water have been found in all Tertiary units, indicating a possibility for deposits in Cloverly, Morrison, Nugget, and Chugwater Formations.—M.C.M.

09965 **Soister, Paul E.** Geologic map of the Muskrat Basin quadrangle, Fremont County, Wyoming: U.S. Geol. Survey Misc. Geol. Inv. Map I-482, scale 1:24,000, section, text, 1966.

No uranium deposits are known in the Muskrat Basin quadrangle. From information available on adjacent areas, the top of the most favorable stratigraphic interval for uranium is probably about 100 feet below the Muskrat Conglomerate Bed of the Wind River Formation.—M.C.M.

09966 **Soister, Paul E.** Geologic map of the Rongis Reservoir SE quadrangle, Fremont County, Wyoming: U.S. Geol. Survey Misc. Geol. Inv. Map I-483, scale 1:24,000, section, text, 1966.

The Wind River Formation, underlying most of the Rongis Reservoir SE quadrangle, has a total thickness of about 650 feet to the south; original thickness at the north boundary was about 1,000 feet, but the removal of most sediments by Quaternary erosion has left less than 150 feet over most of the quadrangle. Uranium deposits, if present, are to be expected almost entirely in the Wind River Formation. No deposits are known in this quadrangle and conditions are less favorable for their presence than in areas to the east, due to: thinness of remaining beds, apparent absence of a single thick extensive mass of arkose, and absence of well defined depressions formed by pre-Wind River erosion and (or) post-Wind

River faulting. The map sheet includes a table of oil and gas wells and test holes.—M.C.M.

Soulé, John H. *See* Finnell, Tommy L. 00219

Souther, J. G. *See* Baragar, W. R. A. 10163

00271 **Spanski, Gregory Thomas.** Geology and geochemistry of the Trail Creek kyanite deposit, Albany County, Wyoming [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2418B–2419B, 1967.

00125 **Spencer, Maria.** Bahamas deep test: Am. Assoc. Petroleum Geologists Bull., v. 51, no. 2, p. 263–268, illus., 1967.

The Bahamas Oil Company, Ltd., Andros No. 1 well, in northern Andros Island, penetrated limestone and dolomite to a total depth of 14,585 feet. Drill cuttings and cores are generally described, and the strata are tentatively subdivided and correlated with rocks of Tertiary and Cretaceous ages in southern Florida. In the Andros well, Tertiary rocks may be as much as 8,760 feet thick, and Upper Cretaceous rocks are 1,900 feet thick. The well was abandoned in Lower Cretaceous rocks without finding a showing of oil or gas.—W.L.A.

00192 **Spencer, Randall S.** Pennsylvanian Spiriferacea and Spiriferinacea of Kansas: Kansas Univ. Paleont. Contr.—Paper 14, 35 p., illus., 1967.

The ranges of thirteen spiriferoid brachiopods, occurring in the Pennsylvanian System of Kansas, have been extended beyond previously known limits. A new subspecies, *Neosperifer latus lateralis*, confined to the Lansing Group, Upper Missourian, is herein proposed. The internal structures of all the species encountered in this study have been examined in serial sections, and several new structures were observed. A polyphyletic origin for *Neospirifer* is suggested. A study of the plication patterns of *Neospirifer* has shown that the pattern of branching on the fold and sulcus is reliable for species identification. Because word descriptions for these patterns are rather lengthy, a shorthand system for describing them was developed.—*from* Author's abstract

Spross, Barbara. *See* Wright, H. E., Jr. 10276

10060 **Sproule, J. C.** Oil and gas prospects of the Canadian Arctic Islands, *in* Commonwealth Mining and Metall. Cong., 8th, Australia and New Zealand, 1965, Proc.—Petroleum, Pubs., V. 5: Melbourne, Australia, Australasian Inst. Mining and Metallurgy, p. 57–64, illus., 1966.

The principal factors involved in assessment of oil and gas prospects in the Arctic Islands of Northwest Territories, aside from climate, terrain, and accessibility, are the great size of the sedimentary basin, and the fact that it is relatively unexplored and has a section involving all systems. Also abundant reservoir and source rocks are known in the up to 60,000 feet of sedimentary rocks. A wide variety and great number of suitable structures, and numerous occurrences of hydrocarbons as seepages or residue, are present. Old tectonic trends are known and should simplify exploration.—E.S.L.

00230 **Stacy, Howard Elwell.** The Lower Cretaceous microfauna from Trinidad and adjacent areas [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 2419B, 1967.

Stadnichenko, Taisia. *See* Zubovic, Peter. 00215

00256 **Stanley, Alan David.** Relations between secondary structures in Athabasca Glacier and laboratory deformed ice [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2419B, 1967.

10050 **Stanley, Daniel J.** Petrology and stratigraphy applied to a problem of river engineering in the lower Mississippi delta, *in* Deltas in their geologic framework: Houston, Tex., Houston Geol. Soc., p. 63–81, illus., tables, 1966.

A study was made of Mississippi delta sediments based on 10 deep borings drilled in a bank of a bend of the river west of Fort Jackson, La. Texture, composition of sand residue, color, water content, plasticity, unconfined compression strength, microfauna, and primary sedimentary structures were examined. The detailed stratigraphy and depositional processes established included several incursions of fluviomarine sediments prograding seaward over deltaic marine sediments; progressive shoaling and increase in rate of deposition accompanied change from shelf to deltaic top-set sedimentation. Borings in the caved and noncaved portions were correlated to interpret causes of bank recession. The bend tends to grow by normal erosional processes, supplemented by deep failure. Lateral displacement during failure occurs above a shell-hash layer at -195 to -205 feet.—E.S.L.

09984 **Stanley, Edward A.** The application of palynology to oceanology with reference to the northwestern Atlantic: Deep-Sea Research, v. 13, no. 5, p. 921-939, illus., table, 1966.

Pollen and spores were studied from over 250 samples of continental shelf and ocean basin sediments from 16 cores, collected chiefly off the east coast of the U.S., in order to obtain a longer and more complete record of the Pleistocene than is generally available from continental deposits. High percentages of reworked plant microfossils at horizons of abundant cold-water Foraminifera are believed indicative of lowering of base level associated with Pleistocene glaciation. Samples collected on the continental shelf yield the largest variety of non-reworked pollen and spores, and these assemblages are considered the most reliable offshore indicators of onshore climate. Percentage of reworked pollen and spores in ocean basin cores appears to be the single most useful palynological criterion for determining the Pleistocene-Recent and intra-Pleistocene boundaries.—V.M.J.

10096 **Stauder, William; Bollinger, G. A.** The S-wave project for focal mechanism studies, earthquakes of 1963: Seismol. Soc. America Bull., v. 56, no. 6, p. 1363-1371, illus., tables, 1966.

P- and S-wave data for 35 of the larger earthquakes of 1963 have been investigated. Fault plane solutions, based on a combination of a graphical and a computer method for determining the poles of the nodal planes, are presented for 26 of these. In all cases the mechanism may be adequately represented by a double couple as an equivalent point source of the focus, although in some few instances a single couple cannot be excluded as an alternate interpretation. The solution of a mid-Atlantic earthquake of November 17, 1963, is given as a clear example of a double-couple focus. Attention is called to the solutions for a series of shocks in the Kurile Islands and to three mid-Atlantic shocks.—D.B.V.

10120 **Stearns, S. Russell.** Cold regions science and engineering—Pt. 1, Sec. A2, Permafrost (perennially frozen ground): Hanover, N. H., U.S. Army Materiel Command, Cold Regions Research and Eng. Lab., 77 p., illus., tables, 1966.

Permafrost underlies much of the regions of high latitude and presents difficulties in construction, operation, and maintenance. The terms and definitions connected with permafrost are reviewed, and distribution (continuous and discontinuous), origin, and structure are discussed. Thickness reaches as much as 2,000 feet, and depth to the top is highly variable. Factors affecting the thermal regime are soil, vegetation, surface water, and heat exchange at the surface. Temperatures within permafrost are shown in graphs and tables, and surface features described. The engineering significance of permafrost is discussed under transportation, buildings, subsurface exploration, icings, water supply, and sewage disposal. A bibliography accompanies the paper, and an appendix on description and classification of frozen soils by Linell and Kaplar is cited separately.—E.S.L.

Steinhart, J. S. *See* Hart, S. R. 00131

00133 **Steinhart, J. S.; Smith, T. J.; James, D. E.** Explosion seismology: Carnegie Inst. Washington Yearbook 65, 1965-66, p. 48-57, illus., 1967.

A combination of seismic data (time-term analysis) southwest of Lake Superior with evidence from gravity anomalies along the midcontinent gravity high shows that

this region (extending to at least Kansas) is one of high density and high velocity within the crust marking a band of material with different properties from those of the Canadian Shield on either side; rocks at depth are probably basic rocks of Keweenawan age. A seismic experiment involving 100 explosions detonated on the continental shelf, slope, and deep water off the middle east coast of the United States in 1965 promises to yield, by means of the time–term analysis, a three dimensional picture of the crust.—V.S.N.

Stephens, J. W. *See* Halberg, H. N. 10181

10292 **Stephens, William M.** Science beneath the sea—The story of oceanography: New York, G. P. Putnam's Sons (Sci. Survey Book), 224 p., illus., 1966.

This science survey book describes how new land is formed out of the ocean as volcanic or coral or mangrove islands, how men are preparing to drill from a floating platform through miles of sea bottom to reach the Earth's mantle, and how drifting organisms of the oceans constitute the largest source of food on Earth. Some of the chapters are concerned with ocean currents, waves, and tides, the floor of the sea and its resources, sounds under the sea, and mining and farming the sea. A new term, oceanology is defined as a wedding of science and engineering, a new concept for a new frontier. The final chapter gives some of the techniques and tribulations as man invades the sea.—G.D.C.

10198 **Stephenson, D. A.; Sclar, C. B.; Smith, J. V.** Unit cell volumes of synthetic orthoenstatite and low clinoenstatite: Mineralog. Mag., v. 35, no. 274, p. 838–846, tables, 1966.

Cell dimensions and densities derived from least squares refinement of X-ray powder diffractometer patterns are: orthoenstatite, a 18.2249 ± 0.0013, b 8.8149 ± 0.0008, c 5.1746 ± 0.0008A, V 831.30 ± 0.14A^3, D 3.208g/cc; low clinoenstatite, a 9.6065 ± 0.0011, b 8.8146 ± 0.0007, c 5.1688 ± 0.0006A, $\beta = 108.335 \pm 0.009$, V $= 415.46 \pm 0.09$A^3, D 3.210 gm/cc. Because orthoenstatite transforms reversibly to clinoenstatite at high pressure and low temperature, and because a statistical test shows that orthoenstatite is less dense than clinoenstatite at the 90 percent confidence level . . . . it is no longer possible to regard low clinoenstatite as a metastable form of $MgSiO_3$.—Authors' abstract

00135 **Stephenson, David A.** Hydrogeology of glacial deposits of the Mahomet Bedrock Valley in east–central Illinois: Illinois Geol. Survey Circ. 409, 51 p., illus., tables, 1967.

Highly permeable sand and gravel aquifers, only developed sources of large ground-water supplies in east–central Illinois, were studied by quantitative methods of geologic evaluation and their three dimensional configurations were determined. Three units recognized within the drift correlate with deposits of three Pleistocene stages: pre–Illinoian—permeable deposits which may exceed 150 feet in thickness and present throughout a large percentage of bedrock channels; Illinoian—a smaller proportion of permeable strata, but most widely used for small and moderate ground–water supplies; and Wisconsinan—less extensive permeable strata except local occurrences. Lithofacies maps determine the three–dimensional distribution of aquifers and illustrate one method of defining aquifer distribution as well as affording the basis for extrapolation of limited hydrologic data.—*from* Author's abstract

10278 **Stewart, Harris B., Jr.** Deep challenge: Princeton, N. J., D. Van Nostrand Co., 202 p., illus., 1966.

This book, an extension of the author's previous book, The global sea (1963), summarizes the new information added to our knowledge of the sea in the past two decades. The total area of the Earth has been calculated at 196,940,000 sq mi, of which 71 percent, 139,715,000 sq mi, is covered with sea water. The nine chapters include discussions of buried landscapes, ocean currents, properties of sea water, mineral and other resources, the abundant and varied life, methods and instruments used in exploring, and international considerations, including cooperation in oceanography.—G.D.C.

Stewart, John H. *See* Wilson, Richard F. 00199

00205 **Stewart, John H.** Possible large right-lateral displacement along fault and shear zones in the Death Valley–Las Vegas area, California and Nevada: Geol. Soc. America Bull., v. 78, no. 2, p. 131–142, illus., 1967.

Significant discontinuities in the thickness of upper Precambrian and Lower Cambrian formations across the Death Valley and Furnace Creek fault zones and the Las Vegas shear zone are considered to have been caused by strike-slip offset. Cumulative right-lateral offset of about 50 miles is suggested across the Death Valley–Furnace Creek fault complex and an offset of 30 miles is suggested across the Las Vegas shear zone. In some places, part of the displacement is taken up in large-scale drag adjacent to the fault zones. To the northwest, the fault zones may grade into large-scale structural bends.—D.H.W.

00184 **Stipp, Thomas F.; Haigler, Leon B.; Alto, Bruno R.; Sutherland, Helen L.** (compilers). Reported occurrences of selected minerals in Arizona (includes most metals and nonmetals; does not include mineral fuels, most sodium and potassium salts, or phosphate): U.S. Geol. Survey Mineral Inv. Resource Map MR-46, 2 sheets, scale 1:500,000, 1967.

Stockman, K. W. *See* Hoffmeister, J. E. 00197

Stoimenoff, L. E. *See* Giroux, P. R. 10104

00176 **Stott, D. F.** Jurassic and Cretaceous stratigraphy between Peace and Tetsa Rivers, northeastern British Columbia: Canada Geol. Survey Paper 66-7, 73 p., illus., 1967.

Jurassic and Cretaceous rocks of northeastern British Columbia comprise a thick succession of intertonguing marine and continental sandstones and shales, resting unconformably on rocks of Triassic age. A regional unconformity within the Cretaceous sequence truncates lowermost Cretaceous and Jurassic strata. Complex facies changes result in many nomenclatorial difficulties. Tentative correlations are presented in tabular form and an extensive appendix presents details of measured stratigraphic sections. [This sequence contains many sandstones and shales which should be considered potential source rocks and reservoirs for oil and natural gas.]—Author's abstract

Stradling, Dale F. *See* Winters, Harold A. 00143

10300 **Stringfield, V. T.; LeGrand, H. E.** Hydrology of limestone terranes in the Coastal Plain of the southeastern United States: Geol. Soc. America Spec. Paper 93, 45 p., illus., tables, 1966.

A water-table circulation system occurs in the very productive Tertiary and Quaternary limestone aquifers at or near the surface, with a homoclinal artesian system confined beneath younger beds in coastal areas. The Eocene–Miocene hydrologic unit is 1,000 feet thick, and is the principal artesian aquifer in Florida and southeastern Georgia, and of lesser importance in North and South Carolina and Alabama. In southeastern Florida the Quaternary limestone forms a shallow but highly productive aquifer. A piezometric map of the principal artesian aquifer reveals direction of flow, chief areas of recharge, and principal discharge areas in stream valleys, springs, and offshore. Solution by downward movement of water has formed tubular openings, and lateral movement has formed caves and other solution channels chiefly in the upper zone of saturation. These caves have been drowned and exposed as the water rose and fell.—E.S.L.

00221 **Stueber, Alan M.; Goles, Gordon G.** Abundances of Na, Mn, Cr, Sc, and Co in ultramafic rocks: Geochim. et Cosmochim. Acta, v. 31, no. 1, p. 75–93, illus., tables, 1967.

The overall average abundances, determined on 113 ultramafic rocks by a neutron activation technique, are (in ppm): Na, 1,040; Mn, 1,040; Cr, 2,980; Sc, 15.7; and Co, 110. These Na, Mn, and Co values are markedly lower than those reported

in the literature. Serpentinization is found to have no effect on the abundances of these elements in ultramafic rocks. For those elements whose abundances are highly dependent on mineralogic composition, such as Na and Sc, the pre-serpentinization mineralogic composition rather than the serpentinization process determines the elemental abundances in the serpentinite.—D.B.V.

10043 **Sullivan, Dan Allen, Jr.** A paleocurrent study of Upper Mississippian and Lower Pennsylvanian rocks in the Frontal Ouachita Mountains and Arkansas Valley [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1992B–1993B, 1966.

Sutherland, Helen L. *See* Stipp, Thomas F. 00184

00273 **Swain, F. M.; Rogers, M. A.; Evans, R. D.; Wolfe, R. W.** Distribution of carbohydrate residues in some fossil specimens and associated sedimentary matrix and other geologic samples: Jour. Sed. Petrology, v. 37, no. 1, p. 12–24, illus., tables, 1967.

The carbohydrate content of 38 fossil specimens analyzed by a phenol–sulfuric acid method ranges from 4 to 900 ppm. The rock matrix associated with the fossils contained carbohydrates in the range 15 to 660 ppm.—*from* Authors' abstract

10044 **Sylvester, Arthur Gibbs.** Structural and metamorphic petrology of the contact aureole of Papoose Flat pluton, Inyo Mountains, California [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1993B, 1966.

Szabo, Michael W. *See* Clarke, O. M., Jr. 09970

Szabo, Michael W. *See* Clarke, O. M., Jr. 09971

Szabo, Michael W. *See* Clarke, O. M., Jr. 09972

Szabo, Michael W. *See* Clarke, O. M., Jr. 09973

10293 **Takeuchi, Hitoshi.** Theory of the Earth's interior: Waltham, Mass., Blaisdell Publishing Co., 131 p., illus., table, 1966.

This is an introductory text to the mathematical techniques necessary for analysis of observational data on the interior of the Earth. The theory of elasticity, viscous fluid motions, and electromagnetics is developed systematically. No particular problem is followed in detail. The four chapter headings are: vector and tensor, fundamental equations, theory of elasticity, and viscous fluid motions and electromagnetic theory.—V.S.N.

10059 **Tanner, William F.** Late Cenozoic history and coastal morphology of the Apalachicola River region, western Florida, *in* Deltas in their geologic framework: Houston, Tex., Houston Geol. Soc., p. 83–97, illus., 1966.

The history of the Apalachicola delta corresponds to the history of sea level since the mid-Tertiary. Principal parts of the delta are: (1) early to middle Miocene deposits, (2) four Miocene–Pliocene terraces at 80, 50, 35, and 25 m, (3) Pleistocene shorelines at 9 and 6 m, (4) beach ridge flat, (5) modern delta, (6) deltaic rim of barrier islands, lagoons, and marshes, and (7) offshore shoals. Granulometry and electron microscopy were used to confirm the origin of these features. Structural features are small; many faults bear N. 50° E. The modern delta is filling an estuary, and the rim is being shaped by breakers and currents. Barrier islands are shorter and inlets wider where beaches are starved.—*from* Author's abstract

10205 **Tatsumoto, M.** Isotopic composition of lead in volcanic rocks from Hawaii, Iwo Jima and Japan: Jour. Geophys. Research, v. 71, no. 6, p. 1721–1733, illus., tables, 1966.

The Pb isotopic compositions and U, Th, and Pb absolute abundances in volcanic rocks from Hawaii, Iwo Jima, and Japan have been determined. Lead from Hawaii and Japan lies close to the isochron of zero age for the Earth. Differences between the primary growth curves for Hawaiian and Japanese leads suggest that continents

and oceans were established early in Earth history. The Pb isotopic compositions indicate that the basalt source region has not remained a closed system and is heterogeneous in chemical composition. The discrepancy between expected and measured U-238/Pb-204 and Th-232/U-238 values suggests that multiple differentiation occurred in the source region, or that the sources of Pb, U, and Th are not the same due to different degrees of partial melting of the heterogeneous upper mantle.—D.B.V.

10213 **Taylor, Ivyl G.** The influence of discontinuities on the stability of an underground opening [with French and German abs.], *in* Internat. Soc. Rock Mechanics Congress, 1st, Lisbon, 1966, Proc., V. 2: Lisbon, Portugal, Laboratório Nacional Engenharia Civil, p. 329–333, illus., 1966.

Discontinuities in a rock mass—joints, faults, bedding planes, schistocity, foliation, and so forth—are the weak links. Assuming the planes of weakness can be defined, then stresses may be compared with strength to determine the factor of safety at any point around an underground opening. Once the factor at critical points has been ascertained, the stability of the opening can be determined by considering the mechanisms of failure. The finite element solution is programmed into high speed computers and used to determine the stress distribution around the opening. The strength of the rock mass with inherent systems of discontinuity is determined by field testing and results programmed for computers. Major discontinuities are treated as boundaries in computations for stress concentration. Jointing, schistocity, etc., are treated as weakened planes of local effect.—*from* Author's abstract

10167 **Tedrow, J. C. F.** Polar Desert soils: Soil Sci. Soc. America Proc., v. 30, no. 3, p. 381–387, illus., tables, 1966.

General characteristics of the Polar Desert soils are dryness, presence of a desert pavement, mildly acid to alkaline reaction, low temperature, and low content of organic matter. A brief review of the literature on polar deserts is given.—Editor's summary

Terasmae, J. *See* Anderson, T. W. 10186

10247 **Terzaghi, Ruth D.** A realistic approach to engineering hazards associated with rock defects, *in* Seminar on "The importance of the earth sciences to the public works and building official," Anaheim, Calif., 1966: Glendale, Calif., Assoc. Eng. Geologists, Los Angeles Sec., p. 172–203, illus., 1966.

The behavior of hard rock *in situ* under stress cannot yet be predicted, but accidents due to defects in the bedrock at construction sites can be reduced by the following precautions: (1) geological investigation sufficiently critical to identify hazardous features; (2) structure designed not to fail under any conceivable combination of unfavorable geologic conditions compatible with the site; (3) periodic observations frequently reviewed critically to provide basis for remedial or preventive measures. Examples of overlooked defects such as joint orientation, ancient rock slides, and subterranean cavities in limestone, salt or basalt, are noted in tunnels in crushed mountains of Taiwan and metamorphic rocks of Austria, the Vaiont Reservoir disaster in northern Italy, rock falls in Norway fiords, and limestone subsidence in an area of brine wells 900 feet deep.—G.D.C.

Thayer, T. P. *See* Brown, C. Ervin. 10297

00250 **Thein, Maung.** A petrological study of the Upper Cambrian rocks in parts of Wisconsin and Minnesota [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2420B, 1967.

Thielman, Henry P. *See* Martinek, Johann. 10331

Thom, B. J. *See* Gagliano, S. M. 00162

Thomas, H. H. *See* Schnetzler, C. C. 00222

10307 **Thompson, Thomas F.** San Jacinto Tunnel, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 104–107, illus., 1966.

The driving of the 13-mile San Jacinto Tunnel, California, proved to be the most difficult project in construction of the Colorado River Aqueduct. Early investigations indicated that hard, mostly massive granitic rocks of Cretaceous age would be the predominant type through which the tunnel would be driven. The suggestions of faulting noted were not expected to present serious difficulties, but the first fault encountered produced a very heavy flow of water. As a result, the ensuing detailed geologic study showed 21 northwesterly striking faults and segments of several east-west faults. This advance knowledge assisted in planning methods of attack in dealing with underground water in unprecedented volume.—E.S.L.

10045 **Thompson, Tommy B.** Geology of the Sierra Blanca, Lincoln and Otero Counties, New Mexico [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1994B, 1966.

00251 **Thoms, John Alroy.** The geology and ore deposits of the Tascuela area, Sierrita Mountains, Pima County, Arizona [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2420B–2421B, 1967.

00178 **Thomson, Keith Stewart.** A new genus and species of marine dipnoan fish, from the Upper Devonian of Canada: Postilla, no. 106, 6 p., illus., 1967.

A single specimen of a new genus and species of lungfish, *Sunwapta grandiceps* gen. et sp. nov., is reported from the marine Upper Devonian of Canada at Sunwapta Pass, Mount Athabasca, Alberta. This large dipnoan has a skull length of about 22 cm, and an estimated standard length of 1 m. The tooth plates are large and lack separate denticles. Lower tooth plates are differentiated peripherally by grooves separating approximately parallel ridges that show signs of becoming subdivided into small denticles. The general structure shows a clear affinity with the families Dipteridae and Dipnorhynchidae, but the fish probably belongs to a group intermediate between the two.—M.S.T.

Thordarson, William. *See* Johnson, H. S., Jr. 10177

10199 **Thorpe, R. I.** Mineral industry of the Northwest Territories, 1965: Canada Geol. Survey Paper 66-52, 66 p., 1966.

This report reviews the mining and exploration activities undertaken in Mackenzie and Keewatin Districts in 1965. Mining is carried out only in Mackenzie where the four principal gold producers had a total production of 446,582 ounces of gold bullion. Exploration in Mackenzie in 11 areas is described for the various properties. Four companies are prospecting in Keewatin and one in Franklin.—M.C.M.

10124 **Tittle, C. W.** Applications of radioisotope instruments in geophysics [with French, Russian, Spanish abs.], *in* Radioisotope instruments in industry and geophysics—A symposium, Warsaw, 1965, Proc., V. 2: Vienna, Austria, Internat. Atomic Energy Agency, p. 3–10, 1966.

Nuclear methods applied to problems in geology and geophysics may be classified as subsurface or borehole, surface, and laboratory methods. Borehole methods, classified on the basis of the nuclear radiation or process types, are natural gamma, neutron-neutron, neutron-gamma, neutron-induced gamma-gamma, gamma-neutron, and time-dependent neutron methods; each is described briefly. Radiotracer methods are used also in subsurface studies of ground-water movement, oil-field operations, and even mineral engineering. Most borehole methods are adaptable to surface and laboratory work. In the United States logging methods most commonly used are the natural gamma and steady-state neutron. The time-dependent neutron method is a very promising new development.—V.S.N.

10287 **Toomre, Alar.** On the coupling of the Earth's core and mantle during 26,000-year precession, *in* The Earth-Moon system—Internat. Conf., Goddard Space Flight Center, NASA, 1964, Proc.: New York, Plenum Press, p. 33–45, 1966.

Direct lunar and solar gravitational torques on the core total about three-quarters of the value needed to make it precess with the same period and angular amplitude as the exterior. The remaining one-quarter of the required moment possibly could be supplied by viscous or turbulent stresses at the core-mantle interface, by magnetic coupling, or by inertial coupling. A new argument is given here which supports the inertial mechanism and based on an estimate indicationg that any steady lag in angle between angular monenta of the mantle and the core cannot exceed 5×10^{8} rad without resulting in a more rapid deceleration of the Earth's rotation than is observed. The minuteness of this angle is used to show that it is implausible that any resulting viscous, turbulent, or magnetic stresses could exert the necessary torque.—V.S.N.

10011 **Trapp, Henry, Jr.** Geology and ground water resources of Eddy and Foster Counties, North Dakota—Pt. 2, Ground water basic data: North Dakota Geol. Survey Bull. 44, pt. 2 (North Dakota Water Conserv. Comm. County Ground Water Study 5), 243 p., illus., tables, 1966.

Part 1 of this report (Bluemle, 1965) describes the geology of Eddy and Foster Counties, and part 3 (to be published later) will describe the ground water resources. Information in part 2, collected chiefly between 1962 and 1965 consists of: data on about 2,000 wells, springs, and test holes; water-level measurements in 100 observation wells; logs of about 193 test holes and selected wells; and chemical analyses of 130 water samples. A map in pocket shows locations of wells, springs, and test holes in the counties.—M.C.M.

Travis, Jack W. *See* Dennison, John M. 00301

10308 **Trefzger, Robert E.** Tecolote Tunnel, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 109–113, illus., 1966.

This tunnel penetrates the Santa Ynez Mountains about 12 mi northwest of Santa Barbara. The mountains are the south limb of an anticline, cut by the Santa Ynez fault, and consist of Tertiary and Cretaceous sedimentary rocks. The fault divides a sequence of younger, north-dipping beds from one of older, south-dipping beds. The principal construction problem was water flows from an intensely fractured siltstone-sandstone contact area within a zone of flexure.—E.S.L.

10316 **Trettin, H. P.; Hills, L. V.** Lower Triassic tar sands of northwestern Melville Island, Arctic Archipelago: Canada Geol. Survey Paper 66-34, 122 p., illus., tables, 1966.

Bitumen deposits in the Bjorne Formation in 1962 were the first reported major showing of petroleum in the Arctic Archipelago, but have no current economic value. The Bjorne, a Lower Triassic marginal facies of the Sverdrup basin, forms a prograding, fan-shaped delta with radiating paleocurrent directions and concentric lithofacies; sediments were from Paleozoic strata to the south. Heavy aromatic oil occurs in six deposits along a forty-mile belt, mainly in porous, partly saturated sandstones and conglomerates, and is concentrated in the upper part below impermeable strata near the depositional limit of the formation, and in basement-controlled sedimentary troughs. Appendixes give stratigraphic thicknesses, paleocurrent determinations, mineralogic and petrographic analysis, size analysis of sand samples, porosity and specific gravity of sandstone, and physical and chemical analyses of bitumen.—E.S.L.

00122 **Turner, R. C.; Brydon, J. E.** Effect of length of time of reaction on some properties of suspensions of Arizona bentonite, illite, and kaolinite in which aluminum hydroxide is precipitated: Soil Sci., v. 103, no. 2, p. 111–117, illus., tables, 1967.

When $Al(OH)_3$ was precipitated in the presence of clays, the reactions were similar, regardless of whether the clay mineral was montmorillonite, illite, or kaolinite. The amount of $Al(OH)_3$ required for the formation of gibbsite was different for the different clay minerals. Gibbsite formed when the initial OH/Al ratio was as low as 0.86. When the initial OH/Al ratio was greater than 2.7, less $Al(OH)_3$ was

required for the formation of gibbsite than when this ratio was less than 2.7. J.W.H.

10146 **Tuthill, Samuel J.; Laird, Wilson M.** Geomorphic effects of the earthquake of March 27, 1964 in the Martin–Bering Rivers area, Alaska: U.S. Geol. Survey Prof. Paper 543–B, p. B1–B29, illus., 1966.

The Alaska earthquake of March 27, 1964, caused widespread geomorphic changes in the Martin–Bering Rivers area—900 sq mi of uninhabited mountains, alluvial flatlands, and marshes at lat 60°30′ N. and long 144°22′ W., 32 mi east of Cordova, and approximately 130 mi east-southeast of the epicenter of the earthquake. Geomorphic effects observed were: ground fractures, mudvent deposits, "earthquake-fountain" craters, subsidence, mudcones, avalanches, subaqueous landslides, turbidity changes in ice-basined lakes on the Martin River glacier, filling of ice-walled sinkholes, gravel-coated snow cones, lake ice fractures, and uplift. The earthquake affected the animal populations of the area and also clearly delineated areas of alluvial fill, snow and avalanche corridors, and deltas of the deeper lakes as unsuitable for future construction.—S.J.T.

00167 **Uchupi, Elazar; Emery, K. O.** Structure of continental margin off Atlantic Coast of United States: Am. Assoc. Petroleum Geologists Bull., v. 51, no. 2, p. 223–234, illus., 1967.

Seismic profiler recordings in 44 profiles between Nova Scotia and the Florida Keys indicate the continental margin was formed by upbuilding on the shelf and prograding on the slope. Upbuilding on the shelf during the Tertiary and Quaternary ranged from 200 to 1,000 m, and seaward prograding on the slope during the same time was from 5 to more than 35 km. Greatest progradation occurred where the slope is flanked by the Blake Plateau rather than by the deep sea. Beds are truncated along some sections of the slope as though the slope had been steepened by submarine erosion. Off Nova Scotia beds of the slope continue into the continental rise; off New England the rise consists of sedimentary layers that have buried the base of the continental slope; and off southeastern United States beds of the Florida–Hatteras slope have prograded atop the older surface of Blake Plateau.—*from* Authors' abstract

09964 **Uchupi, Elazar.** Map showing relation of land and submarine topography, De Soto Canyon to Great Bahama Bank: U.S. Geol. Survey Misc. Geol. Inv. Map I–475, scale 1:1,000,000, 1966.

10225 **Ulrich, George E.; Klemic, Harry.** Geologic map of the Caledonia quadrangle, Trigg and Christian Counties, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ–604, scale 1:24,000, section, text, 1966.

Two deep tests for oil drilled in the Caledonia quadrangle in the late 1920's and penetrating the Chattanooga Shale (Upper Devonian) were nonproductive holes reportedly with shows of oil and gas. Limestone possibly of chemical grade and also suitable for road metal or aggregate occurs as crossbedded oolitic chert-free units 20–30 feet thick near Julien along Sinking Fork. Ground water is probably the most important natural resource in the area. Most wells drilled to levels at or below adjacent stream beds and shallow wells in areas of numerous sink holes usually provide enough water for domestic use. Presence of water is controlled largely by connecting fractures which follow the trends of dominant jointing.—M.C.M.

00153 **U.S. Coast and Geodetic Survey.** (compiler). Bathymetric map, Santa Barbara to Huntington Beach, California—(Provisional) 1206N–15: Rockville, Md., U.S. Coast and Geod. Survey, scale 1:250,000, 1967.

U.S. Geological Survey. *See* Am. Assoc. Petroleum Geologists. 00152

10082 **U.S. Geological Survey.** (Systematic Literature Research Unit). Bibliography of North American geology, 1964: U.S. Geol. Survey Bull. 1234, 944 p., 1966.

10083 **U.S. Geological Survey.** (Systematic Literature Research Unit). Bibliography of North American geology, 1962: U.S. Geol. Survey Bull. 1232, 834 p., 1966.

VanLopik, Jack R. *See* Kolb, Charles R. 10049

00218 **Vaughn, W. W.** A simple mercury vapor detector for geochemical prospecting: U.S. Geol. Survey Circ. 540, 8 p., illus., 1967.

The detector utilizes a large-volume atomic-absorption technique for quantitative determinations of mercury vapor thermally released from crushed rock. A quartz-enclosed noble-metal amalgamative stage, which is temperature controlled and is actuated by a radio-frequency induction heater, selectively traps the mercury and eliminates low-level contamination. As little as 1 part per billion of mercury can be detected in a 1-gram sample in a 1-minute analytical period.—Author's abstract

Veroda, Victor J. *See* Kansas Geological Society. 10066

10190 **Voight, Barry.** Beziehung zwischen grossen horizontalen Spannungen im Gebirge und der Tektonik und der Abtragung [with English and French abs.]. *in* Internat. Soc. Rock Mechanics Cong., 1st, Lisbon, 1966, Proc., V. 2: Lisbon, Portugal, Laboratório Nacional Engenharia Civil, p. 51-56, illus., 1966.

Stress components of tectonic origin can be important locally, but in many instances of large horizontal near-surface stress, the influence of tectonics could be subordinate. Consider a rock element with depth reduced by superficial denudation from Z^* to Z. The new vertical stress σ_z is approximately γZ. The horizontal stress remains a function of Z^*, and cannot be computed from σ_z. A decay function reduces non-equilibrium values of σ_z following denudation. It can be shown that σ_z cannot decrease to a magnitude less than σ_z ultimate equilibrium. Most regions characterized by a history of moderate denudation will have $N \geq 1$ at shallow crustal levels. Large magnitudes of horizontal stress in rock masses should not be regarded as atypical.—*from* Author's abstract

10208 **Voight, Barry.** Restspannungen im Gestein [with English and French abs.]. *in* Internat. Soc. Rock Mechanics Cong., 1st, Lisbon, 1966, Proc., V. 2: Lisbon, Portugal, Laboratório Nacional Engenharia Civil, p. 45-50, illus., 1966.

Residual stresses are systems of stresses existing in equilibrium (or approaching equilibrium) in the interior of a solid when neither normal nor shear stresses are being transmitted through its surface. Thus defined, residual stresses have significance in rock mechanics and in several areas of geology, notably structural geology and petrology. Some of the more important aspects [faulting, gross lateral crustal pressure and creep recovery, and the like] are discussed in this paper.—Author's abstract

10008 **vonArx, William S.** Level-surface profiles across the Puerto Rico Trench: Science, v. 154, no. 3757, p. 1651-1654, illus., 1966.

Preliminary observations have been made from a ship of the warping of the geoid across the Puerto Rico Trench. Astrogeodetic and gravimetric measurements of the deflections of vertical and the corresponding level-surface profiles are compared for this site. The accuracies at which level-surface topography would provide a useful datum at sea are mentioned with reference to oceanographic requirements.—Author's abstract

09995 **Vonhof, J. A.** Water quality determination from spontaneous-potential electric log curves: Jour. Hydrology, v. 4, no. 4, p. 341-347, illus., table, 1966.

Spontaneous-potential deflections on electric logs of testholes drilled in Pleistocene deposits in Saskatchewan have made it possible to estimate the quality of water in a particular aquifer easily and conveniently. It is necessary, however, for the specific conductance of the drilling mud to be less than that of the formation water, and since the relationship observed is empirical, additional data should be obtained to establish the statistical precision of estimates.—V.S.N.

vonHuene, R. E. *See* Hamilton, E. L. 10134

00198 **VonHuene, Roland; Shor, George G., Jr.; Reimnitz, Erk.** Geological interpretation of seismic profiles in Prince William Sound, Alaska: Geol. Soc. America Bull., v. 78, no. 2, p. 259–268, illus., 1967.

A series of seismic reflection profiles was made during the summer of 1964 in the northeastern part of Prince William Sound, Alaska. The three rock units recognized in the profiles are (1) the ice-sculptured metamorphic basement, overlain by (2) probable glacial drift, and (3) Holocene marine sediments. Channels in the basement may have been formed in part by faulting as well as by glacial scour; they may have been extensively modified by fill of rock units (2) and (3), so that the present sea floor does not closely represent the effects of glaciation. The Holocene strata have been faulted, but the vertical separation is small, suggesting any profound deformation of the sound in the past 10,000 years has been by tilting or arching.—Authors' abstract

10097 **Vozoff, Keeva; Ellis, Robert M.** Magnetotelluric measurements in southern Alberta: Geophysics, v. 31, no. 6, p. 1153–1157, illus., 1966.

Results are presented of magnetotelluric measurements at three locations in southern Alberta. At two stations interpretations using Cagniard's theory are consistent with other measurements which show a conductivity discontinuity near 80 km. However, at the station closest to the Rocky Mountains, the conductivity increase appears at approximately 35 km. In this case, it is unlikely that the long period decrease in the apparent resistivity curves is due to source effects.—Authors' abstract

09999 **Waddell, Dwight E.** Pennsylvanian fusulinids in the Ardmore basin, Love and Carter Counties, Oklahoma: Oklahoma Geol. Survey Bull. 113, 128 p., illus., tables, 1966.

The Fusulinidae of the Pennsylvanian limestone members in the Ardmore basin (Bostwick through Daube Members, Atokan through Missourian age), are described. Of the 17 species, *Fusulinella vacua, Fusulina mutabilis, F. erugata, Triticites tomlinsoni* are new. Seven fusulinid biozones are discriminated and correlated with those of other midcontinent areas. The biozones are based on a biologic scale which subdivides only the fusulinid evolutionary continuum and is completely independent of lithologic implications. Speciation is based on relationship among morphological variables in a general time series; statistical discrimination was used to a large extent in speciation of this fauna. Measured sections, measurement data for species, and application of multivariate analysis and linear discriminant function, are given in appendixes.—V.M.J.

10048 **Wadsworth, A. H., Jr.** Historical deltation of the Colorado River, Texas, *in* Deltas in their geologic framework: Houston, Tex., Houston Geol. Soc., p. 99–105, illus., 1966.

The modern delta of the Colorado was deposited very rapidly, growing from 45 acres in 1908 to 7,098 acres in 1941, due largely to removal of a log jam at the mouth in 1929. In prehistoric times the river flowed with the Brazos, into a large bay farther east. Other abandoned channels have been traced. When the modern delta reached across Matagorda Bay to Matagorda Peninsula in 1936, a channel was dredged across the delta and the offshore bar so that the river emptied into the Gulf, and the old delta growth stopped. The birth, development, and completion of a deltaic cycle can be studied here.—E.S.L.

Wagner, Holly C. *See* Griggs, Roy L. 10178

09956 **Wahl, Kenneth D.** Geologic map of Pickens County, Alabama: Alabama Geol. Survey Map 40, scale about 1 in. to 1 mi., text, 1966.

The geologic units that crop out in Pickens County are of sedimentary origin and consist chiefly of chalk, clay, sand, and gravel. The Cretaceous deposits are divided, in ascending order, into Tuscaloosa Group (Coker and Gordo Formations), McShan Formation, Eutaw Formation, and Selma Group (Mooreville and Demopolis

Chalks). Along major streams these deposits are overlain by Quaternary terrace deposits and alluvium.—M.C.M.

00142 **Walker, H. J.** Delta lakes in the Arctic [abs.]: Assoc. Am. Geographers Annals, v. 57, no. 1, p. 193, 1967.

Walker, R. M. *See* Fleischer, R. L. 00114

Walker, R. M. *See* Fleischer, R. L. 00115

00274 **Walker, Roger G.** Turbidite sedimentary structures and their relationship to proximal and distal depositional environments: Jour. Sed. Petrology, v. 37, no. 1, p. 25–43, illus., tables, 1967.

The variability of internal sedimentary structures of turbidites has been investigated for 3,352 beds in 7 sections (2 in Upper Devonian of Maryland; 2 Upper Miocene, 1 Pliocene, 1 Upper Eocene of California; 1 Ordovician of Pennsylvania). The sand fraction can be divided from base upward into graded, lower laminated, and current rippled divisions. A parameter P_1 is derived, based on proportions of beds in a group beginning with any one division, and which, therefore, is directly related to flow regimes of the depositing currents. As environment becomes more distal and P_1 decreases bed thickness decreases exponentially, erosion becomes less common, and parallel and cross laminae increase; combined data define normal and abnormal turbidity current behavior. In vertical section, P_1 can demonstrate regular, irregular, or cyclic changes in proximality during basin filling.—V.S.N.

Wallace, George B. *See* Rouse, George C. 10214

Walper, Jack L. *See* Walthall, Bennie H. 00282

00282 **Walthall, Bennie H.; Walper, Jack L.** Peripheral Gulf rifting in northeast Texas: Am. Assoc. Petroleum Geologists Bull., v. 51, no. 1, p. 102–110, illus., 1967.

The Gulf fault system forms the northern periphery of the Gulf Coast geosyncline and follows an arcuate trend parallel to and south of the front of the Ouachita tectonic belt. Comparisons show this fault system, composed of the Balcones Luning, Mexia–Talco, South Arkansas and Pickens–Gilbertown fault zones, has many characteristic features in common with the classic rift systems of Africa and Europe. Conclusions are based on review of features and characteristics of known rift systems and a study of the Mexia–Talco rift zone in northeastern Texas, which exhibits little or no surface relief. Abundance of data on this unique association of rift faulting, a tectonic belt, and geosynclinal development, provides unique opportunities for study of relations between mechanics of rifting, post-orogenic events and basin tectonics.—B.H.K.

10215 **Wang, Yih-Jian; Singh, Madan M.** A numerical method for the determination of stresses around underground openings [with French and German abs.], *in* Internat. Soc. Rock Mechanics Congress, 1st, Lisbon, 1966, Proc., V. 2: Lisbon, Portugal, Laboratório Nacional Engenharia Civil, p. 363–373, illus., 1966.

A numerical method is presented for determining the nature and magnitude of stresses that exist around underground openings in either massive or stratified rocks. The rock is considered to be elastic and homogeneous in each stratum, although physical properties of each bed may vary. Friction between several strata is taken into account. The method employs a plane-strain discrete model, for which the finite-difference equations of equilibrium and boundary conditions are formulated. Equations are solved numerically by the iteration method in terms of displacements, from which stresses are computed. Two illustrative problems, for the case of bedded rock, are included.—*from* Authors' abstract

10228 **Warn, Fred.** Sinkhole development in the Imperial Valley, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 144–145, illus., 1966.

Features usually associated with karst topography occur in Recent lake sediments in southwestern Imperial County, Calif. The surface is nearly flat and sediments consist of fine-grained clastic material deposited by freshwater Lake Cahuila, which disappeared about 400 years ago. Some evaporites are disseminated through the strata. Subterranean piping, during the occasional winter storms, is facilitated by water movements through burrows, mudcracks, joints, and bedding planes. Ground water occurs in sand and silty sand aquifers. These features create stability problems in highway construction.—E.S.L.

10311 **Warn, Fred.** Analysis and correction of a highway slide near San Diego, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 136–143, illus., 1966.

A slide occurred in a new cut slope along Route U.S. 395, 17 mi north of San Diego. Geologic data from field and airphoto studies indicated that it was a fault-controlled slump. Materials on the slope consisted of 10–30 feet of overburden resting on fractured volcanic rock. The overburden consisted of 1–3 feet of residual soil overlying deeply weathered volcanic material. Most of the fractures in the bedrock had slickensided surfaces with net displacement along the slide surface of more than 70 feet. Initial movement was along a pre-existing bedding fault surface but the central part broke through this surface. The slide was corrected by a cut slope to undercut the fault plane; material above and to the south of the slide was removed to avoid additional slides. Two secondary slides occurred during this excavation.—E.S.L.

10322 **Warner, Lawrence A.** A triangular scheme for crystal morphology: Jour. Geol. Education, v. 14, no. 5, p. 183–186, illus., table, 1966.

The seven permissible crystal forms in any crystal class can be related by an equilateral triangle. Three are assigned to vertices, and three having two indices equal, or a third equal to zero, univariant, are assigned to legs; the seventh, general for the class, is assigned to the area within the triangle. Forms may be numbered from one to seven so that the sum of the numbers for any fundamental, and the opposite univariant, will equal the number of the general form, taken as seven. The sum of the numbers of any two fundamental forms equals the number of the related univariant form. For any three numerically related forms, the sum of the Miller indices for the two with lower numbers will give simplest indices for the third. Poles of reference faces plotted on a stereogram fall on a single spherical triangle; relationship of the forms to this will be the same as given by the plane equilateral triangle.—*from* Author's abstract

10161 **Washburn, A. L.** J. J. O'Neill (1886–1966): Arctic, v. 19, no. 4, p. 361, 1966.

Watson, R. A. *See* Wright, H. E., Jr. 10276

00257 **Webster, Gary Dean.** Biostratigraphy of the pre-Desmoines part of the Bird Spring Formation, northern Clark and southern Lincoln Counties, Nevada [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2421B, 1967.

Welday, E. E. *See* Baird, A. K. 00208

09977 **Welder, George E.; McGreevy, Laurence J.** Ground-water reconnaissance of the Great Divide and Washakie Basins and some adjacent areas, southwestern Wyoming: U.S. Geol. Survey Hydrol. Inv. Atlas HA-219, 3 sheets, scale 1:250,000, sections, table, geol. map, separate text, 1966.

Rocks that underlie the Great Divide-Washakie Basins area range in age from Precambrian to Recent. Individual formations change greatly in lithology and thickness throughout the area and many units transgress geologic time. Tectonic activity began in Late Cretaceous and extended through middle Eocene. The text outlines the general geology and hydrology of the Great Divide and Washakie Basins, and the Rock Springs, Sierra Madre, and Rawlins uplifts. Water in the area is generally under artesian pressure, but unconfined locally, it is available to wells except in places underlain by thick impermeable rocks; yield would probably range from <1 to about 1,000 gpm. Quality varies from very poor to excellent.

Sheet 1 is a geologic map, sheet 2 a ground-water map, and sheet 3 a generalized section. A table of chemical analyses of water from wells and springs is included on sheet 2.—M.C.M.

00308 **Wells, Dana; Renton, John J.; Perkins, Robert L.** Normal faulting in the Caldwell–Lewisburg area of Greenbrier County, West Virginia: West Virginia Acad. Sci. Proc. 1966, v. 38, p. 155–158, illus., 1967.

This report, although preliminary in nature and yet requiring more conclusive field proof, indicates that the area was exposed to a period of tension probably following the regional compression which resulted in the formation of the Browns Mountain anticline. In any event, it provides further proof that the tectonic history of the Browns Mountain area is more complex than has been previously reported and that normal faulting is a significant tectonic element in the regional structure.—Authors' abstract

10241 **West, Phillip J.; Hunt, Gail S.** San Onofre Nuclear Generating Station, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 380–387, illus., 1966.

The San Onofre plant is on the coast of southern California inside the Camp Pendleton Military Reservation, so that cooling water is available from the ocean. Formations involved in construction were the Pliocene Capistrano and San Mateo Formations, Pleistocene terrace deposits, and Recent alluvium and beach sand. The only faulting observed was the pre-Pleistocene disturbance along the Christianitos fault about a mile south. Active landslides were seen south of the fault, but none in the site area. Seismicity studies showed the site to be free of epicenters; earthquake occurrences have been much less severe and frequent than in other southern California communities. However, ample allowance was made in construction. Ground-water study showed that flow would continue to be toward the ocean. Tsunami protection was also made much higher than any expected waves.—E.S.L.

10286 **Weyl, Richard H.** Desarrollo paleogeográfico y morfológico del espacio centroaméricano [abs.], *in* Unión Geog. Internac. Conf. Regional Latinoamericana, Mexico, 1965, Proc., V. 3: México, D. F., Soc. Mexicana Geografía y Estadística, p. 153–154, 1966.

Whetten, J. T. *See* Coombs, D. S. 00201

00252 **Wiebe, Robert Alan.** Structure and petrology of Ventana Cones area, California [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2421B–2422B, 1967.

00226 **Wier, Kenneth L.** Geology of the Kelso Junction quadrangle, Iron County, Michigan: U.S. Geol. Survey Bull. 1226, 47 p., illus., tables, geol. map, 1967.

Precambrian rocks underlie all of Kelso Junction quadrangle, eastern Iron County, Mich., in subparallel belts striking northwestward and dipping steeply southwestward along the southwestern flank of the anticlinal Amasa oval. Lower Precambrian Margeson Creek Gneiss, exposed in the northeast corner, is overlain by the middle Precambrian Animikie Series—Randville Dolomite, Hemlock and Amasa Formations, Michigamme Slate, Badwater Greenstone. Sills and dikes intrude the strata, and gross structure is simple as the area lies between the Amasa oval and the synclinal Iron River–Crystal Falls basin southwest of the quadrangle. Two periods of metamorphism are reflected in the rocks. Magnetic surveys reveal that anomalies are caused chiefly by metavolcanic flows and pyroclastics. Iron from the Amasa Formation is uneconomic for "taconite"-type beneficiation.—V.S.N.

Wilder, Hugh B. *See* Harris, William H. 10189

00253 **Williams, Roy Edward.** Shallow hydrogeology of glacial drifts in northeastern Illinois [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2422B, 1967.

10256 **Williams, S. A.** Morphological data on some minerals from the Cliff vein, Keweenaw County, Michigan: Arizona Geol. Soc. Digest, v. 8, p. 177–181, illus., 1966.

Morphological descriptions are given of ten well-crystallized mineral specimens from the Cliff mine, in the Cliff vein, Keweenaw County, Michigan. The minerals described are chalcocite, native silver, native copper, prehnite, datolite, hematite, barite, laumontite, azurite, and cuprite.—M.S.T.

00306 **Willis, Joe C.** Sediment transportation mechanics—Initiation of motion—Discussion [of paper 4738, 1966]: Am. Soc. Civil Engineers Proc., v. 93, Jour. Hydraulics Div., no. HY 1, p. 101–107, illus., tables, 1967.

Critical motion tests for flow over a sand bed illustrated the variability of results for different bed configurations and bed-material characteristics. The tests were conducted on three bed materials with median diameters of 0.31 mm, 0.40 mm, and 0.61 mm and for bed forms that developed for low flow velocities (about 0.8 fps). A quantitative delineation of the individual contributions of bed forms and grain factors to the critical flow parameters was not possible because the bed forms were themselves dependent on the grain characteristics. Ripple formation and dissipation are described, and critical flow parameters are shown in graphs.—J.W.C.

10003 **Wilson, Charles W., Jr.; Barnes, Robert H.; Morrow, William E.** Geologic map of the Petersburg quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 72-SW, scale 1:24,000, separate text, 1966.

The accompanying text, "Mineral resources summary of the Petersburg quadrangle, Tennessee," by C. E. L. McCary, 1966, is cited separately.—M.C.M.

10006 **Wilson, Charles W., Jr.; Barnes, Robert H.** Geologic map of the Auburntown quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 319-NE, scale 1:24,000, separate text, 1966.

The accompanying text by Wilson, "Mineral resources summary of the Auburntown quadrangle, Tennessee," 1966, is cited separately.—M.C.M.

10086 **Wilson, Charles W., Jr.** Mineral resources summary of the Auburntown quadrangle, Tennessee: Nashville, Tenn., Tennessee Div. Geology, 3 p., 1966.

The accompanying map, Tennessee Div. Geology Geol. Map 319-NE, by Wilson and R. H. Barnes, 1966, is cited separately. Of the limestone formations exposed in the Auburntown quadrangle, the Carters and Bigby-Cannon are best suited for most general uses; the one quarry in the area is inactive. Gravel has been dug from bars along streams and used for road metal; remaining reserves are small. Although no chert production has been reported nor pits found, chert is abundant in residuum of the Fort Payne Formation.—M.C.M.

00199 **Wilson, Richard F.; Stewart, John H.** Correlation of Upper Triassic and Triassic(?) formations between southwestern Utah and southern Nevada: U.S. Geol. Survey Bull. 1244-D, p. D1–D20, illus., 1967.

The Chinle Formation (Upper Triassic) of southwestern Utah and southern Nevada is the probable correlative of the Chinle (Triassic), Moenave and Kayenta (Triassic?) Formations of the Glen Canyon Group in southwestern Utah. Three principal units of this strata are recognized between the Moenkopi Formation and Navajo Sandstone in Utah and between the Moenkopi and Aztec Sandstone (Navajo equivalent) in Nevada. In Utah lower and middle members are here called the Shinarump and Petrified Forest Members of the Chinle (probable equivalents are recognized in Nevada); the upper is divided into the Moenave and Kayenta Formations of the Glen Canyon Group, but no such division can be made in Nevada. A unit similar to the Chinle, present between the Shinarump(?) and the unquestioned Moenkopi Formation in Nevada, is tentatively retained in the Moenkopi.—V.S.N.

10301 **Wilson, Robert R.; Mayeda, Henry S.** The First and Second Los Angeles Aqueducts, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 62–71, illus., 1966.

The First Aqueduct, as defined here, includes the original Owens River Aqueduct and the Mono Basin Extension, built 1934–1941. Mono Craters and Elizabeth Tunnels are the most interesting geologically of the more than 100 tunnels. The former pierces the volcanic necks underlying the craters, and penetrates a large variety of rocks. Large volumes of water under high pressure and charged with CO_2 were one of the greatest difficulties. Elizabeth Tunnel is entirely in granitic rocks; the San Andreas fault is 5,000 feet wide where crossed by the tunnel, but no significant movement has been detected. The Second Aqueduct, due to be completed in 1969, will extend from Haiwee Reservoir to Van Norman Lakes, a distance of 153 miles. Geologic investigation of the proposed route was completed in June 1966. Construction of cross sections of tunnel areas and major fault crossings is in progress.—E.S.L.

10323 **Winchester, John W.** Terrestrial heat flow, radioactivity, and the chemical composition of the earth's interior: Jour. Geol. Education, v. 14, no. 5, p. 200–204, tables, 1966.

Rate of heat flow from the Earth's interior is calculated by measuring thermal conductivity of rock and geothermal gradient. The average is about 1.5 μ cal/cm^{2}sec, with no detectable difference between continent and ocean areas. Below 50 m, temperatures are determined by inside sources, of which radioactive decay of U, Th, and K is the most important. By comparing measured values of heat flow with calculations based on Earth-composition models and assumption of a thermal steady state, boundary conditions may be placed on variation of chemical composition with depth. This supports the thesis that the Earth's average radioactive-element composition is that of chondrites, and the crust is strongly enriched relative to the mantle in these elements. Since granites are much richer than basalts in radioactive elements, equality of heat flow from continental and oceanic areas remains unexplained.—*from* Author's abstract

00143 **Winters, Harold A.; Stradling, Dale F.** The Yakima folds—Some relationships between topography and structure [abs.]: Assoc. Am. Geographers Annals, v. 57, no. 1, p. 194–195, 1967.

10171 **Wolfe, Jack A.** Tertiary plants from the Cook Inlet region, Alaska: U.S. Geol. Survey Prof. Paper 398-B, p. B1–B32, illus., 1966.

Taxonomic relations of some plants from the Paleocene Chickaloon Formation and the Neogene Tsadaka and Kenai Formations are considered. Sixteen new species from the Kenai are described and greatest emphasis is on members of Salicaceae and Betulaceae. Flora of the Kenai may be divided into three large stratigraphic floral types: Seldovian, probably early and middle Miocene, an assemblage dominated by deciduous woody dicotyledons, members of genera now characteristic of warm-temperate eastern Asia and eastern North America; Homerian, probably late Miocene, a cool-temperate assemblage dominated by species of Salicaceae, Betulaceae, Rosaceae, and Ericaceae; and Clamgulchian, probably Pliocene, in which most of the relict warm-temperate genera present in the Homerian are absent. The concept of the Arcto-Tertiary geoflora does not appear to be valid.—*from* Author's abstract

Wolfe, R. W. *See* Swain, F. M. 00273

00191 **Wood, Roger, C.** A review of the Clark Fork vertebrate fauna: Breviora, no. 257, 30 p., illus., tables, 1967.

The Clark Fork fauna is known from only one area in the Bighorn Basin of northwestern Wyoming. No Clarkforkian quarry or pocket has yet been discovered, so that this fauna has never been well characterized, nor the validity of this provincial age well substantiated. The author has reviewed collections and studied original maps, and concludes that of 107 specimens of Clark Fork fauna, only 4 specimens representing 4 species can be ascribed to a possible latest Paleocene fauna in the

Polecat Bench Formation. Only one of these species may be unique to a Clark Fork fauna. the evidence scarcely warrants recognition of the Clark Fork as a provincial age, faunal zone, or member of the Polecat Bench Formation.—M.S.T.

00136 **Woodward, Lee A.** Stratigraphy and correlation of late Precambrian rocks of Pilot Range, Elko County, Nevada, and Box Elder County, Utah: Am. Assoc. Petroleum Geologists Bull., v. 51, no. 2, p. 235–243, illus., 1967.

Metasedimentary rocks believed to correlate lithologically with Units C, D, E, F, and G of the late Precambrian McCoy Creek Group are exposed in the Pilot Range. Unit G is disconformably overlain by the Lower Cambrian Prospect Mountain Quartzite (restricted).—A.E.R.

Worts, G. F., Jr. *See* Malmberg, G. T. 10202

10166 **Wright, G. M.** Geological Survey conducts Canada-wide investigations, *in* Contributions to geological exploration in Canada: Canada Geol. Survey Paper 66–42, p. 2–3, table, 1966.

Field investigations by the Geological Survey of Canada in 1965 included 112 full-season projects, many other studies of limited scope or short duration, and six aeromagnetic surveys by contract; distributions of main field parties, by scientific function and geological regions is shown in a table. Normal progression in regional geological studies is to apply detailed investigations of topics and areas as a follow-up of reconnaissance and in support of progress in mineral exploration. Diversity of studies and development of new methods, techniques, and instruments are supported by an extensive array of laboratory service and research work.—M.C.M.

10276 **Wright, H. E., Jr.; Spross, Barbara; Watson, R. A.** Pollen analyses of the sediment from sinkhole ponds in the central Kentucky karst: Natl. Speleol. Soc. Bull., v. 28, no. 4, p. 185–188, illus., 1966.

Cores from two ponds in limestone sinkholes in the central Kentucky karst were examined for pollen analysis in the hope that a study of forest migration and climatic history during glacial and post-glacial time would help in interpretation of cave history. A core from Ruth Dale pond failed to yield pollen below 450 cm, apparently as a result of rapid erosion and deposition of sediments. The failure of the ponds to provide long sedimentation records suggests that such records will have to come from studies of lakes of different origins in other regions, such as the southernmost glacial lakes in Indiana and Ohio. This study of sinkhole ponds does show, however, that sinkholes are actively forming and are subject to rapid sedimentation, partly due to extensive cultivation during the last century, which has caused rapid erosion of residual clay.—M.S.T.

Wyder, J. E. *See* Lissey, A. 10317

Yon, J. William, Jr. *See* Hendry, Charles W., Jr. 00168

10224 **Young, Keith.** Texas Mojsisovicziinae (Ammonoidea) and the zonation of the Fredericksburg: Geol. Soc. America Mem. 100, 225 p., illus., tables, 1966.

The Fredericksburg Group (Lower Cretaceous) of Texas ranges in age from Middle to Upper Albian, including the Walnut, Comanche Peak, and Goodland Formations, overlain by the Kiamichi Formation of the Washita Group. Four zones of acanthoceratacean ammonites of the subfamily Mojsisovicziinae are here based on a number of published and unpublished detailed sections. The occurrence in texas of *Venezoliceras* with other South American ammonites suggests that its range, restricted to uppermost Middle and lowermost Upper Albian, cannot differ greatly in South America. The 29 species described, of the genera *Adkinsites, Venezoliceras, Oxytropidoceras, Manuaniceras, and Dipoloceras*, include 14 new. Primitive and specialized characters are outlined, some ideas of evolution are illustrated, and distribution is related to lithology.—G.D.C.

10046 **Young, Richard Andrew.** Cenozoic geology along the edge of the Colorado Plateau in northwestern Arizona [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1994B–1995B, 1966.

00144 **Zakrzewska, Barbara.** The nature of geographic studies of land forms [abs.]: Assoc. Am. Geographers Annals, v. 57, no. 1, p. 195–196, 1967.

00160 **Zakrzewska, Barbara.** Trends and methods in landform description: Assoc. Am. Geographers Annals, v. 57, no. 1, p. 128–165, 1967.

This paper reviews ideas of American geographers on geographic landform analysis and proposes a framework within which geographic landform studies can be identified and related to other landform studies. The following approaches are identified as geographic: 1) descriptive analysis of the present landform; 2) functional analysis of landform; 3) analytical studies of the covariation of individual landform elements; and 4) analytical studies of spatial variations in landform. Selected methods used in such studies are summarized and evaluated. Special emphasis is placed on descriptive methods.—Author's abstract

00238 **Zelasko, Joseph Simon.** An investigation of the influences of particle size, size gradation and particle shape on the shear strength and packing behavior of quartziferous sands [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 7, p. 2350B, 1967.

10321 **Zielbauer, Edward J.** Sea water intrusion and the barrier projects, *in* Engineering geology in southern California: Glendale, Calif., Assoc. Eng. Geologists (Los Angeles Sec. Spec. Pub.), p. 264–269, illus., 1966.

Hydrogeologic investigations of sea-water intrusion have been made in the coastal margins of Los Angeles, Orange, and Ventura Counties. The first successfully operated sea-water barrier formed by well injection was constructed along Santa Monica Bay to protect and recharge the West Coast ground-water basin, and a pumping project for ultimate barrier use was recently initiated on an experimental basis in the Hueneme area. Two other barriers are planned at Dominiguez Gap and Alamitos. Detailed geologic and hydrologic studies were conducted along each barrier alinement. Aquifers are Pliocene–Recent, and only in the Alamitos project are structural features important—the Seal Beach fault and an elongated dome.—E.S.L.

Zietz, Isidore. *See* Sims, P. K. 00154

10047 **Ziony, Joseph Israel.** Analysis of systematic jointing in part of the Monument Upwarp, southeastern Utah [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 27, no. 6, p. 1995B, 1966.

00215 **Zubovic, Peter; Sheffey, Nola B.; Stadnichenko, Taisia.** Distribution of minor elements in some coals in the western and southwestern regions of the Interior coal province: U.S. Geol. Survey Bull. 1117-D, p. D1–D33, illus., tables, 1967.

A study was made of the distribution of 15 minor elements in 48 columnar coal samples of Pennsylvanian age and 4 samples of lignite of Eocene age in the Western Interior region. Coals from northern Oklahoma, Iowa, and Missouri generally contain more beryllium, boron, vanadium, chromium, cobalt, nickel, copper, zinc, gallium, germanium, molybdenum, and yttrium than do coals from the Oklahoma–Arkansas basin. Tin and lanthanum were found in larger amounts in the latter region, whereas titanium was found in about equal amounts. The distribution of the elements, particularly yttrium and lanthanum, suggests that the Oklahoma–Arkansas basin was a main drainageway for the inland sea in Des Moines time. Weathered coals contain larger quantities of most of the elements than do unweathered coals.—P.Z.

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